ACCOUNTING MEASUREMENT AND BETA RISK MEASURES

by

Marcus Alexander Burger

A dissertation submitted to the faculty of
The University of Utah
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

in

Business Administration

David Eccles School of Business

The University of Utah

August 2012

The University of Utah Graduate School

STATEMENT OF DISSERTATION APPROVAL

The dissertation of **Marcus Alexander Burger**

has been approved by the following supervisory committee members:

Christine Botosan	, Co-Chair	**May 2, 2012** Date Approved
Asher Curtis	, Co-Chair	**May 2, 2012** Date Approved
Marlene Plumlee	, Member	**May 2, 2012** Date Approved
James Schallheim	, Member	**May 2, 2012** Date Approved
Michael Halling	, Member	**May 2, 2012** Date Approved

and by **William Hesterly** , Chair of

the Department of **David Eccles School of Business**

and by Charles A. Wight, Dean of The Graduate School.

ABSTRACT

Prior literature provides evidence that accounting beta risk measures—based on the covariance between firm-specific and marketwide accounting rates of return—better estimate the risk implied by market prices than do stock returns beta risk estimates based on realized equity returns. Because capital markets might distort the realized equity return inputs used by traditional Capital Asset Pricing Model implementations, prior literature suggests that accounting rates of return might better capture the risk associated with firms' future earnings. I hypothesize that accounting policies can also distort accounting betas. I examine whether the price deviations for value estimates based on accounting betas are associated with firms' unconditional accounting conservatism and past investment growth. Specifically, I document that accounting betas based on return on equity are negatively associated with a firm's combined level of conservative accounting and the absolute value of the firm's past investment growth. Further, I find that the conservative accounting and past investment growth distortion in accounting betas outweighs the benefit of using accounting betas relative to stock returns betas. The evidence suggests that accounting betas best estimate risk when firms have less conservative accounting policies and smaller magnitudes of absolute past investment growth.

To Amy, Arim, and Emma

CONTENTS

LIST OF TABLES

ACKNOWLEDGMENTS

I would like to thank my dissertation committee for their help and support while I developed my dissertation. My cochairs, Christine Botosan and Asher Curtis, have been especially helpful as they have carefully dedicated much time to its development. I have also received many helpful and insightful comments from the other members of my committee, including Marlene Plumlee, Jim Schallheim, and Michael Halling. I am also grateful to other members of the University of Utah faculty, including Sarah McVay, Rachel Hayes, Melissa Lewis, and Brian Cadman, who also provided many helpful comments during several workshop presentations of my thesis. Finally, but not least, I am grateful to my Ph.D. student colleagues who provided very much needed support and encouragement.

CHAPTER 1

INTRODUCTION

In all but the most primitive valuation approaches such as the use of earnings multiples, calculating firm value essentially involves two tasks. The first task is to forecast a firm's future cash flows, and the second is to determine the rate of return required to discount the cash flows back to their present values. Although forecasting and risk analysis are widely considered the provinces of statisticians and researchers in asset pricing, alternatively they can be considered exercises in accounting for a firm's future (Penman, 2010a). Both forecast estimates and risk estimates are derived from observables that are presumed to proxy for the key parameters in theoretical forecast and risk models.[1] Since the conceptual documents of the Financial Accounting Standards Board (FASB) and International Accounting Standards Board (IASB) suggest that a purpose of accounting is to help financial statement users forecast and assess the timing and uncertainty of future cash flows, accounting should provide the observable firm characteristics to proxy for the key parameters in the set of forecast and risk models that are used by investors.[2]

Although a purpose of accounting is to aid in firm valuation, accounting represents a design choice by the firm and by standard-setters. A broad research question is then which accounting best facilitates valuation. A standard feature of U.S. Generally Accepted Accounting Principles (GAAP) is the measurement and estimation of accruals. Accruals are used to improve a firm's periodic earnings measurement by better matching the revenues of business activities with their corresponding expenses. Despite accrual accounting's

[1]Both forecasting and risk determination draw from the hypothesized relationships of the expected conditional distributions of key parameters. Forecasts derive their predictions from an application of the expected parameter relationships to current observables, and risk derives from the expected distribution of the errors in those predictions based on prior realizations (Penman, 2010a).

[2]FASB Statement of Financial Accounting Concepts No. 8 and Chapter 1 of the IASB Conceptual Framework simultaneously suggest that the objective of general purpose financial reporting is to provide financial information to investors to allow them to assess the amount, timing, and uncertainty of future cash flows.

objectives, revenue and expense recognition remains at least partially subjective because it relies on estimates.[3] To the extent that the accrual estimates are imprecise, they might distort the forecast and risk models that use them as inputs. U.S. GAAP specifies accrual estimates that vary across different classes of assets and liabilities. For example, due to the uncertainty of returns associated with firms' advertising expenditures, U.S. GAAP requires firms to immediately expense rather than capitalize such expenditures. Another example is fair value accounting that values assets or liabilities according to their current market rates so that interperiod accruals might be recognized even in periods when they might be expected to reverse in subsequent periods that the firm carries the asset or liability.[4] I examine how one broad set of accrual recognition methods, which I label conservative accounting, might affect risk analysis in valuation.

I restrict my examination to the effects of conservative accounting on rate of return estimates that are derived from the Capital Asset Pricing Model (CAPM). The CAPM represents a traditional approach to modeling investment risk based on the covariance between an investment's return and the return obtained from a market-mimicking investment portfolio. Although prior literature suggests that the CAPM might not adequately model investment risk as implied by market returns, I focus on the CAPM in my analysis for two reasons. First, as stated previously, an objective of accounting is to provide the observables necessary to proxy for the key parameters among the set of risk models that are used by investors. Despite its limitations, the CAPM remains among the most popular risk models used by corporate managers to assess risk (Graham & Harvey, 2001). Second, recent literature suggests that the CAPM yields, on average, superior risk estimates when it is derived using accounting estimates of firm and market portfolio returns than when it is derived using stock market estimates of firm and market portfolio returns.

Nekrasov and Shroff (2009) and Cohen, Polk, and Vuolteenaho (2009) provide evidence that CAPM estimates derived from the estimated covariances between firm-specific accounting return on equity (ROE) and marketwide accounting return on equity yield valuation errors that are on average smaller than the traditional CAPM estimates derived from firm-specific and marketwide stock returns. In general, the papers define valuation

[3]For example, it is impossible for accounting to precisely allocate a productive asset's depreciable life to its units of production because even a depreciation allocation method having a unit basis is unable to fully accomodate the variance among the set of similar assets' productive capacities.

[4]Fair value accounting is frequently used for financial instruments having active markets. The motivation for fair value accounting is that it provides a better representation of value based on current market conditions.

errors as the differences between market-implied risk premiums and the premiums obtained from risk estimates. The prior literatures' findings suggest that investors should adopt the accounting-based CAPM beta (accounting beta) as a superior alternative to the stock returns-based CAPM beta (stock returns beta).[5]

I contribute to the literature by providing evidence that accounting betas are not only a function of a firm's systematic risk, but also of its firm-specific accrual accounting methods. I provide evidence that suggests accounting-based measures of risk are predictably biased by a common measurement technique used in accounting: the tendency to conservatively report asset values and earnings. I examine whether the on average superior performance of accounting betas over stock returns betas is associated with a firm's level of conservative accounting methods. I predict that conservative accounting, when combined with past investment growth, biases accounting betas so that firms having more conservative accounting appear less risky than they actually are. Consequently, I also predict that accounting betas, when estimated for firms having more conservative accounting, will, on average, yield larger valuation errors than stock return betas that are estimated for the same set of firms.

I define conservative accounting as the set of accrual methods that reports an investment at a carrying value that yields an accounting rate of return greater than the internal rate of return based on the investment's original cost.[6] I predict that because conservative accounting distorts accounting rates of return, it might also distort accounting betas. Rajan, Reichelstein, and Soliman (2007) model the association between accounting rates of return and a firm's conservative accounting and past investment growth. They find that in the presence of investment growth, an increase in conservative accounting reduces ROE and magnifies the effect of any further increase in investment growth. Similarly, given conservative accounting, an increase in investment growth reduces ROE and magnifies the effect of any further increase in conservatism on ROE. To summarize, Rajan et al. (2007) provide analytical and empirical evidence of a negative association between firms'

[5]Research has not yet examined the extent to which practitioners use risk estimates that are similar to accounting beta. Some anecdotal evidence, however, suggests that accounting betas are used by practitioners. For example, the Certified Valuator and Analyst test preparation materials discuss risk estimates that closely resemble an accounting beta. Despite the limited evidence of accounting beta's use in practice, I remain motivated to investigate accounting beta to better understand how accounting might affect risk assessments, especially those that might be based on the covariances of rates of return.

[6]In contrast to the conditional accounting conservatism literature (e.g., Basu, 1997), I use a definition of accounting conservatism that is independent of future cash flow expectations. The immediate expensing of advertising costs is an example of (unconditional) conservative accounting where the investment has an immediate carrying value equal to zero and the possibility for an infinite accounting rate of return.

accounting rates of return and the interaction between their conservative accounting and past investment growth.

I extend the analysis of Rajan et al. (2007) to hypothesize that accounting betas are negatively associated with a firm's conservative accounting and the absolute value of its past investment growth. To derive my predictions, I extend the Rajan et al. (2007) model to include two additional assumptions. First, I assume that firms' investment rates tend to be procyclical (Stock & Watson, 1999). Second, I assume that firms with unbiased accrual accounting have accounting rates of return that also tend to be procyclical. Combining the Rajan et al. (2007) model predictions with these assumptions, a firm that applies unbiased accrual accounting standards will observe increasing accounting rates of return during economic expansion and decreasing accounting rates of return during economic contraction. In contrast, due to the negative association between accounting rates of return and the interaction between conservative accounting and past investment growth, as a firm applies more conservative accrual accounting standards, it will observe an increasingly negative bias in its accounting rate of return during periods of economic expansion and an increasingly positive bias during periods of economic contraction. With the added assumptions, conservative accounting combines with absolute investment growth to weaken a firm's accounting rate of return covariance with other firms. I therefore predict a negative association between accounting beta estimates and a firm's level of conservative accounting and the absolute value of its past investment growth.

Following Rajan et al. (2007), I estimate a firm's degree of conservative accounting as an increasing function of the sum of its research and developement (R&D) and advertising expenses divided by its total capital expenditures. Rajan et al. (2007) suggest that the relevant period of investment growth for determining the extent of the bias in accounting rates of return occurs over the average useful life of a firm's assets. Similarly, I expect that the relevant period of growth associated with the time-series bias in the ROE covariance of accounting betas is also approximated by the average useful life of a firm's assets. Therefore, I follow Rajan et al. (2007) to also estimate past investment growth as the geometric average growth in total expenditures over the average estimated useful life of a firm's assets. However, because I predict that the covariance between a firm's ROE and the market's ROE is diminished as the firm applies more conservative accounting and either grows or shrinks investment, I examine the absolute value of a firm's average past investment growth.

I perform panel regressions of accounting betas on estimates for conservative accounting and the absolute value of past investment growth, and I find evidence of a negative association between accounting betas and the interaction between conservative accounting and the absolute value of past investment growth. The evidence supports two possible interpretations. First, firms that use more conservative accounting during periods of economic expansion or contraction might be less risky than firms that use less conservative accounting policies. Alternatively, conservative accounting might combine with economic expansion or growth to weaken the covariance between firm and market ROE, as predicted, and cause firms that have more assets or liabilities that are subject to conservative accounting standards to have downwardly biased accounting betas.

To distinguish between these two interpretations, I compare the valuation errors for accounting beta risk estimates to stock returns beta risk estimates. If stock returns beta estimates are less vulnerable to the impact of conservative accounting and if they are reasonable proxies for risk in their own right, I predict that their valuation errors will be smaller than those of accounting beta estimates when they are estimated for conservative accounting firms during periods of economic growth or contraction.[7]

Examining the valuation error differences between accounting beta and stock returns beta provides evidence of the measurement distortion in accounting betas that is associated with conservative accounting. It also investigates whether one risk measure is superior in such settings. Although prior literature suggests that accounting betas are on average superior risk estimates to stock returns betas, they might not be superior risk estimates when they are used to estimate the risk of firms that have more conservative accounting. Further, an examination of the valuation error differences between accounting beta and stock returns beta might also provide evidence on another accrual accounting method: fair value accounting. If stock returns are a sufficient proxy for fair value accounting rate of return estimates, then stock return betas might also be considered fair value accounting betas. The conclusions drawn from the valuation error differences between accounting betas and stock return betas might then be interpreted as the differences between conservative accounting betas and fair value accounting betas.

[7]Penman and Zhang (2002) document evidence that investors fail to immediately fully adjust for the ROE distortion caused by accounting conservatism and investment growth so that they incorporate the distortion into prices and subsequent returns. If the market is able to significantly adjust for the bias in accounting rates of return due to conservative accounting and if the association between accounting betas and conservative accounting and the absolute value of past investment growth is not associated with risk, I would expect that stock return beta estimates would yield smaller valuation errors than accounting beta estimates when they are estimated for firms that have more conservative accounting. In contrast, if I do not observe significant valuation error differences between accounting betas and stock returns betas for firms having more conservative accounting, I would be unable to distinguish between the risk explanation or the market's inability to sufficiently adjust for the conservative accounting bias that is present in accounting rates of return.

For my primary tests, I follow Cohen et al. (2009) to estimate valuation errors as the residuals from ordinary least squares (OLS) regressions of discounted simple realized future market portfolio returns on either accounting beta or stock returns beta. Realized market portfolio returns proxy for investors' expected rates of return. In Chapter 5, I examine an alternative valuation error estimate based on the residuals from a regression of an implied cost of equity capital estimate on each beta measure. I derive similar conclusions using either valuation error estimate.

I sort firm-year valuation error differences into two-dimensional quintile portfolios based on each firm's level of conservative accounting and absolute value of past investment growth. I find that stock returns beta valuation errors are significantly smaller than accounting beta valuation errors for portfolios of firms that have more conservative accounting and greater absolute values of past investment growth. The evidence is consistent not only with the presence of conservative accounting distortions in accounting betas during periods of economic expansion or contraction, but also with stock returns betas providing superior risk estimates for firms that have more conservative accounting during periods of increasing or decreasing past investment growth.

To summarize, I contribute to the literature by exploring the extent to which accrual accounting methods distort accounting beta risk estimates. To my knowledge, I am the first to examine the association between accounting measurement attributes and accounting beta risk estimates. I document evidence that investors should consider firms' accrual accounting methods when using accounting-based risk estimates to assess firm risk. Further, when evaluating and comparing the relative valuation errors of accounting-based and market-based risk estimates, my results suggest that the relative superiority of accounting-based risk estimates is contextual. While prior research suggests that, on average, accounting beta estimates are superior to stock returns beta estimates, my findings suggests that by understanding the impact of accounting conservatism and investment growth on accounting betas, practitioners and researchers can better choose the appropriate risk measure. My results suggest that (1) accounting betas are negatively biased by conservative accounting and (2) that stock returns betas provide a superior meaure of risk over accounting betas for firms that use more conservative accounting during periods of highly fluctuating economic growth.

The remainder of my dissertation is organized as follows. Chapter 2 reviews the CAPM and more recent accounting beta literature. Chapter 3 develops my primary hypotheses and conducts the related tests. Chapter 4 provides robustness tests of these results. In Chapter

5, I use an implied cost of equity capital estimate to derive an alternative valuation error estimate. I use the alternative estimate to examine independent tests of the accounting beta valuation error that do not rely on a comparison to stock returns beta. In general, the tests support my examination of the valuation error differences between accounting beta and stock returns beta. In Chapter 6, I summarize my overall findings and provide concluding remarks.

CHAPTER 2

LITERATURE REVIEW

Standard valuation involves two primary tasks that are readily demonstrable via the simple dividend discount model. The dividend discount model describes asset value (V_t) as

$$V_t = \sum_{\tau=1}^{\infty} \frac{E(d_{t+\tau})}{\delta^{\tau}}, \qquad (2.1)$$

where ($E(d_{t+\tau})$) is the expected dividend or cash flow generated by the asset in period $t+\tau$ and δ is equal to one plus a constant discount rate. The two valuation tasks required to estimate the model are (1) forecasting future cash flows or dividends and (2) estimating the discount rate that will incorporate future cash flow uncertainty into the model. My research objective is to examine which accounting best facilitates valuation. I focus specifically on how accrual recognition methods affect discount rate, or cost of capital, estimates.

I restrict my examination to the effects of conservative accounting on cost of capital estimates derived using the CAPM. In this chapter, I review the CAPM literature, including the debate over the model's theoretical and empirical validity.[1] I argue that despite the CAPM's empirical shortcomings, its simplicity and thoroughly examined theoretical underpinnings motivate its continued extensive use in the classroom and in practice as a tool for evaluating investment risk (Fama & French, 2004; Graham & Harvey, 2001). After briefly reviewing the progression of the CAPM debate and its current status in the literature, I then introduce and discuss the recent motivation for an empirical accounting alternative to stock returns beta. I conclude the chapter by motivating my analysis of the contextual precision of this accounting alternative.

2.1 The CAPM

CAPM was developed based on mean-variance efficient portfolio choice theory that assumes investors are risk-averse rational utility-maximizers that care only about the mean

[1]For a more extensive review of this literature, see Campbell, Lo, and MacKinlay (1997) and Fama and French (2004).

and variance of their investment choices (Markowitz, 1959). Investors' behavior leads them to maximize utility by choosing among the set of investment portfolios that have the highest expected return for a given expected return variance. Extant literature refers to these portfolios as the set of mean-variance efficient portfolios.

Sharpe (1964) and Lintner (1965) extend mean-variance efficient portfolio choice theory to identify a portfolio that must be mean-variance efficient in order to clear the market of all assets. They assume that investors hold homogeneous expectations of the expected future joint distribution of asset returns and that investors' expectations are fully rational so that the agreed-upon distribution reflects economic reality. They also assume investors can borrow unlimited amounts at the risk-free rate, and that the market is frictionless so that it will not prevent efficient trading. After imposing these additional assumptions, Sharpe (1964) and Lintner (1965) find that investors' set of mean-variance efficient portfolio choices collapses to a linear set of choices where the different portfolios are all comprised of various weightings between the risk-free asset and a single tangency portfolio in the same relative proportions. The derivation of a linear set of portfolio choices obtains due to the assumption that investors hold homogeneous expectations so that all investors, irrespective of their level of risk aversion, hold a weighted portfolio of the risk-free asset and the unique tangency portfolio. Because all investors hold the same tangency portfolio combined with the risk-free investment, the tangency portfolio must be the value-weighted market portfolio in order to allow the set of all market assets to clear.

The implications of the Sharpe (1964) and Lintner (1965) analysis are that the market portfolio is among the set of mean-variance efficient portfolios and that the expected returns of each asset or portfolio of assets can be expressed as a function of the amount of variance that it contributes to the market portfolio. Formally, the expected return on asset i ($E(R_i)$) can be expressed as

$$E(R_i) = R_f + \beta_{im}(E(R_m) - R_f), \tag{2.2}$$

where R_f is the return on the risk-free asset, $E(R_m)$ is the expected return on the market portfolio, and

$$\beta_{im} = \frac{cov(R_i, R_m)}{var(R_m)}. \tag{2.3}$$

Equation (2.2) is the traditional Sharpe-Lintner CAPM equation. The right-hand side of the equation expresses asset i's expected return as the sum of a risk-free rate and a risk premium, where the risk premium is modeled as the product of CAPM beta (β) and expected excess market returns ($\beta_{im}(E(R_m) - R_f)$). As the slope in equation (2.2), CAPM beta measures the sensitivity of asset i's returns to the variation in the excess market return. Alternatively, CAPM beta measures the additional variance that asset i contributes to the overall market based on its returns' covariance with the market.

The CAPM applies to valuation because it can be used to estimate the discount rate. For example, the CAPM estimates δ in Equation (2.1) as

$$\hat{\delta} = 1 + \hat{R}_f + \hat{\beta}_i(\hat{R}_m - \hat{R}_f). \tag{2.4}$$

Following CAPM theory, Equation (2.4) models the estimated discount rate as a linear function of a risk-free rate and a risk premium that corresponds to the valuation asset's return covariance with the market.

Black (1972) derives a more general version of the CAPM that does not assume the existence of a risk-free asset. Allowing for unrestricted short-selling of risky assets, Black (1972) shows that the market portfolio remains among the set of mean-variance efficient portfolios. Without a risk-free asset, investors continue to choose among the mean-variance efficient portfolios. For all market assets to clear, the market portfolio must then equal a value-weighting of all the mean-variance efficient portfolios that are selected by investors. Since a value-weighted portfolio of mean-variance efficient portfolios must also be mean-variance efficient, the market portfolio must also be mean-variance efficient.

Fama and French (2004) argue that the CAPM assumptions of both the Sharpe-Lintner model and the Black model are unrealistic. For example, they argue that it might be unreasonable to believe that investors hold homogeneous expectations of future returns distributions, that there is unlimited borrowing and lending at the risk-free rate, or that investors can engage in unlimited short-selling among risky assets. Fama and French (2004) acknowledge, however, that many theoretical models contain unrealistic assumptions necessary to simplify the model's analysis. As a result, the merits of a model are best determined by empirical evidence.

Empirical tests generally focus on three CAPM model implications. One model implication is that beta completely encapsulates the cross-sectional variation in expected excess future returns. If investors hold homogeneous expectations and consider only an investment's expected return and variance, then no other variable should provide marginal explanatory power for expected excess future returns.[2] The Sharpe-Lintner CAPM model can be rewritten to express expected excess returns as a function of the risk premium.

[2]These tests also assume that investors do not systematically misprice future cash flows.

Therefore, a second implication of the Sharpe-Lintner CAPM model is that an intercept term, when included in the empirical estimate for beta, should approximate zero. The Sharpe-Lintner model also implies that the market risk premium $(E(R_m) - R_f)$ is positive. Otherwise, investors would invest in only the risk-free rate or a zero-beta asset and the model would fail to explain investors' observable market responses.

The literature's early empirical tests of the CAPM largely support the version of the model by Black (1972) but not the Sharpe-Lintner version (Black, Jensen, & Scholes, 1972; Blume & Friend, 1973; Fama & MacBeth, 1973). They find evidence suggesting that the market portfolio is among the set of mean-variance efficient portfolios and that returns are significantly positively associated with beta; however, the beta and average return association for the Sharpe-Lintner model is weaker than expected, suggesting that other factors might also explain the cross-sectional variation in returns (Fama & French, 1992).[3]

The strongest evidence against the CAPM began appearing in the late 1970s with the beginning of the anomalies literature that attempts to identify variables to explain the variation in excess returns beyond what is explained by CAPM beta. Some of the best-known anomalies include the price-to-earnings (Basu, 1977), size (Banz, 1981; Fama & French, 1992, 1993), market-to-book (Fama & French, 1992, 1993), momentum (De Bondt & Thaler, 1985; Jegadeesh & Titman, 1993), and accrual anomalies (Sloan, 1996). The research associated with each of these anomalies finds evidence that beta does not comprehensively explain excess stock returns. Part of the response in the literature has been to examine theoretical risk model alternatives to the CAPM, including multifactor models based on arbitrage pricing theory (Ross, 1976). For example, Fama and French (1992, 1993) examine a multifactor model based on firm characteristics believed to influence the sensitivity of a firm's stock returns to systematic risk. They combine beta with two factors based on market-to-book and size and document evidence that their additional factors explain excess stock returns both independently and when combined with a beta based on stock returns.

In contrast, the literature has also responded to evidence against the CAPM by investigating the restrictive assumptions that are imposed by empirical CAPM estimates. These papers argue that the interpretation of the CAPM tests is made more difficult by the inability to distinguish between a failure of the CAPM assumptions or of the empirical

[3]Kothari, Shanken, and Sloan (1995) re-examine the earlier evidence of the weak association between average stock returns and beta and document a significant positive association having a more reasonable compensation level between 6 to 9%, per year. The authors find this result after controlling for potential survivorship and winner-loser bias and examining a longer time horizon of data.

assumptions used to estimate the model. CAPM empirical estimates require some additional assumptions that might significantly impede any true test of the model.

Standard empirical CAPM implementations require three inputs: expected asset returns, expected market returns, and a risk-free asset return. The model is often estimated for equity assets so that empirical estimates frequently use realized stock returns to proxy for expected returns. The Standard and Poor's 500 Index (S&P 500) is most commonly used to proxy for the market portfolio, and the U.S. Treasury bill is most commonly used as a proxy for the risk-free asset (Campbell et al., 1997). Using ordinary least squares (OLS) regression, the time-series model is estimated as:

$$(Ret_{it} - Ret_{ft}) = \alpha_i + \beta_{im}(Ret_{500,t} - Ret_{ft}), \tag{2.5}$$

where Ret_{it} is firm i's realized stock return at time t, Ret_{ft} is the treasury bill rate at time t, and $Ret_{500,t}$ is the S&P 500 return at time t.[4] I refer to the traditional stock returns-based empirical model presented in Equation (2.5) as the stock returns beta model. It is the model most frequently estimated in the extant literature.

In a seminal critique of the prior empirical tests, Roll (1977) emphasizes that the market portfolio proxy is incomplete and tests that reject the CAPM only reject the market portfolio proxy. However, later research suggests that CAPM test inferences are largely insensitive to the portfolio of assets chosen to proxy the market portfolio. Stambaugh (1982) examines alternative market portfolio proxies and provides evidence that test inferences are similar regardless of whether a stock-based, bond-based, real-estate-based, or a combination of the three is used. Further, Kandel and Stambaugh (1987) and Shanken (1987) provide evidence that as long as the proxy for market portfolio expected excess returns is highly correlated with the expected excess returns of the true market portfolio, then CAPM test inferences will not be weakened by the proxy choice.

Arguments have also arisen against the evidence in support of multifactor models, particularly those that seem to have arisen from the anomalies literature. They argue that the strong association between expected future returns and variables other than CAPM beta might be due to data-snooping or sample-selection bias. Data-snooping biases refer to statistical biases that are caused by applying the inferences obtained from one dataset to subsequent research questions that are examined using the same dataset. Lo and MacKinlay (1990) examine the potential magnitude of data-snooping bias in tests of the Sharpe-Linter CAPM using analytical tests, Monte Carlo simulations, and some empirical

[4] According to the Sharpe-Lintner version of the model, α_i should equal zero for each asset.

analysis. They demonstrate that data-snooping bias can be significant, although they are unable to quantify the exact extent to which data-snooping might have affected current research conclusions regarding the CAPM. Still, they provide a warning that data-snooping biases can substantially influence financial research.

Sample selection biases refer to inference biases that occur when research design choices systematically exclude firms from an analysis that is intended to yield results that are generalizable. For example, Kothari et al. (1995) argue that the book-to-market anomaly studies suffer from survivorship bias. They argue that the bottom book-to-market percentiles in the risk factor tests conducted by Fama and French (1992) and Fama and French (1993) are underrepresented since firms having low book-to-market ratios are usually poor performing and would be excluded from a sample that examines future returns because they would no longer be among the set of firms having actively traded securities. Therefore, a future returns test that examines the lowest book-to-market precentiles would be biased toward including only those poor performing firms that are able to turn-around their operations. Fama and French (1996) later dispute the book-to-market bias; however, sample selection bias remains a general concern in the CAPM literature.

To examine the validity of alternative arguments for and against the CAPM, Campbell et al. (1997) conduct a statistical analysis of returns deviations from the CAPM. They model expected deviations based on four scenarios. In the first scenario, they assume that the CAPM fully explains future returns. In the second scenario, they assume that the CAPM omits a relevant risk factor, implying that a multifactor model more appropriately models risk. In the third and fourth scenarios, they examine the possibility that the CAPM implementation is biased or that returns cannot be modeled by traditional risk factor analysis. In the third scenario, they examine a scenario where a nonrisk-based explanation has only a moderate impact on return deviations. In the fourth scenario, they examine a scenario where they have greater impact. In general, they find evidence that the failure of beta to explain average returns is most consistent with a nonrisk-based explanation rather than with a missing risk factor explanation.

To summarize, prior literature's support for the CAPM is mixed. Current research fluctuates between criticisms of the unrealistic CAPM assumptions, including the evidence against these assumptions, and criticisms of the imprecise empirical estimates of CAPM beta along with their related assumptions. Much of the current literature either examines theoretical alternatives to the CAPM or improvements to the model's potentially flawed empirical implementation. In the next section, I review a subset of the literature that examines potential empirical improvements to CAPM estimates by using accounting inputs rather than stock return or market-based inputs to estimate CAPM beta. I refer to this set of alternative empirical estimates as accounting beta estimates.

2.2 Accounting Beta

Although standard practice estimates common risk factors using the joint realized return distributions of past stock returns and marketwide returns (stock returns beta), it is unclear what aspects of fundamental risk are captured by the covariance between realized stock returns and marketwide returns. Since firm value, earnings, and risk arise from firms' operating, financing, and investing activities, some observers advocate using the distributional characteristics of earnings to estimate risk (Baginski & Wahlen, 2003; Nekrasov & Shroff, 2009). Prior literature in accounting and finance both support the notion that accounting provides information that is fundamental to risk assessment. For example, Beaver, Kettler, and Scholes (1970) examine the correlation between accounting-based risk measures and stock returns-based measures, and Fama and French (1995) examine whether their size and book-to-market risk factors are associated with similar factors for earnings.

Others argue that the variances and covariances of stock returns might capture market information that is irrelevant to the average investor's risk assessments (Cohen et al., 2009). Specifically, accounting might better capture investors' expectations of future excess returns if, on average, investors adopt buy-and-hold strategies. As investors' investment holding periods increase, the relevant investment risk shifts from short-term nondiversifiable investment return variance to the nondiversifiable variance in firms' long-term earnings performance. Similarly, Brainard, Shapiro, and Shoven (1991) argue that, if markets are even slightly inefficient, mispricing may contaminate not only average stock returns but also the risk measures that use them as inputs. In summary, if accounting inputs are better proxies for the risk relevant to investors, then accounting-based risk estimates might better predict future realized returns than stock returns-based estimates.

Prior accounting research in valuation motivates risk measures that are founded on modern finance theory. Feltham and Ohlson (1999) advocate using risk measures that are associated with the nondiversifiable variability inherent in expected future residual income. In their analysis, they argue the equivalence between market value of equity and book value of equity using assumptions of no arbitrage and clean surplus accounting. They then demonstrate how traditional cost of capital theories in finance can be directly applied to accounting valuations derived using the residual income model and encourage researchers to explore risk estimates that are founded on strong economic theory.[5]

Accounting betas are built on the strong financial theory of the CAPM but also represent accounting-based estimates. While stock returns betas are CAPM estimates that use realized stock returns to proxy for expected returns, accounting betas are CAPM estimates that use reported accounting rates of return to proxy for expected returns. Specifically, investors would estimate accounting betas according to the following empirical model:

$$(ROE_{it} - Ret_{ft}) = \alpha_i + \beta_{im}(ROE_{500,t} - Ret_{ft}), \tag{2.6}$$

where ROE_{it} is firm i's reported accounting return on equity (ROE) at time t, Ret_{ft} is the treasury bill rate at time t, and $ROE_{500,t}$ is the ROE estimated for the S&P 500 at time t. In Equation 2.6, the S&P 500 portfolio of firms is used as a proxy for the market portfolio; however, other empirical proxies might be chosen.[6] From the equation, one can see that accounting beta is the empirical accounting analog to stock returns beta (Equation (2.5)) in that it uses an accounting rate of return, ROE, instead of stock returns as a proxy for investment returns.

Cohen et al. (2009) motivate the use of accounting inputs to estimate CAPM beta by using the price-to-book decomposition performed by Vuolteenaho (2001, 2002) and Cohen, Polk, and Vuolteenaho (2003). The decomposition shows that, to a very close approximation,

$$\log\left(\frac{ME_t}{BE_t}\right) = \sum_{j=1}^{\infty} \rho^j \log(1 + ROE_{t+j}) - \sum_{j=1}^{\infty} \rho^j \log(1 + R_{t+j}). \tag{2.7}$$

In Equation (2.7), ME_t and BE_t are lagged market equity and book equity, respectively. Cohen et al. (2009) argue that over an infinite horizon, the unexpected realizations of the ROE summation will equal the unexpected realizations of the stock returns summation so that infinite-horizon ROE should approximate infinite-horizon stock returns. The

[5]Feltham and Ohlson (1999) also emphasize that proper valuation involves discounting firm's future expected abnormal earnings by applying the discount directly to the numerator. In their analysis, they demonstrate that the ad hoc risk adjustment applied by appending the risk premium directly to the discount rate in the denominator assumes that a firm's abnormal earnings over time and across various projects have equivalent risk. They suggest that although this might be an acceptable approach in practice to simplify estimation, it might not always be acceptable in theoretical work. Because my objective is to examine the effects of conservative accounting methods on risk assessment as typically conducted by investors, my analysis should not be affected by focusing on theories that use a simplified model that adjusts risk in the denominator of a valuation.

[6]According to the Sharpe-Lintner version of the CAPM model, α_i should equal zero for each asset.

sums, however, might differ over a finite horizon. Alternatively, accounting beta might be motivated from general arbitrage pricing theory (APT), which suggests that investment risk arises from the covariance of returns with a kernel in the economy.[7] Applying APT to accounting, the covariance of a firm's earnings with economy-wide earnings seems an adequate substitute (Penman, 2010a).

The empirical estimation for accounting betas suffers from two potential drawbacks compared to stock returns betas. First, accounting betas require long estimation horizons due to less frequent accounting data. Second, the market index is somewhat ad hoc because their is no market index ROE equivalent to a stock returns index. Also, because the frequency of accounting data is inconsistent across firms, the market portfolio must be constructed using the most recent lagged accounting information for each firm, which will have staggered measurement horizons. When using annual financial accounting data to estimate betas, the differences in the accounting measurement horizons for each firm in the portfolio might be significant.

Because accounting information is generally backward-looking, accounting betas might not provide as good of estimates as return betas in some contexts. In essence, stock returns potentially have an information advantage over accounting rates of return because they are able to incorporate expectations regarding future returns. However, because accounting focuses on actual performance, it omits any speculation that might be driving returns and that investors might not consider relevant to risk assessment, particularly if they face longer holding periods. Consequently, it is an empirical question whether accounting betas or stock returns betas best capture the economic risks underlying firms' value-generating processes. The measures are imperfectly correlated and thus must capture somewhat different underlying constructs (Beaver et al., 1970). The measures might capture different aspects of risk that are imperfectly correlated. Alternatively, they might differ in the degree to which they reliably measure risk.

Beaver et al. (1970) are the first to investigate accounting betas. They examine the correlations between stock returns beta and accounting beta to determine whether they capture similar constructs. They document evidence that accounting beta is weakly associated with stock returns beta. The two measures also exhibit dissimilar time-series behavior. Whereas portfolio stock returns betas calculated over 1947-1956 are highly correlated with the stock returns betas from the same portfolio calculated over 1957-1965, they find very weak correlations for portfolio accounting betas estimated over the same periods. Beaver

[7] APT encapsulates the CAPM.

et al. (1970) compare the correlation between accounting beta and stock returns beta to six other accounting measures for risk, including earnings variance, average dividend payout, average asset growth, and average asset size. In general, they find evidence that accounting beta appears to have a stronger positive association with stock returns beta than all other measures except earnings variance and average dividend payout.

Baginski and Wahlen (2003) examine the association between accounting beta and the priced risk premium implicit in stock prices. They estimate the priced risk premium as the difference between a residual income model valuation of a firm, discounted using only a risk-free rate, and the contemporaneous market price for the firm. They document a significant positive association between accounting beta and the priced risk premium, but they find that accounting beta explains little of the premium's cross-sectional variation compared to the amount of cross-sectional variation explained by stock returns beta or the Fama and French (1992, 1993) risk factors.

Cohen et al. (2009) re-examine the relative explanatory power of stock returns beta using an alternative measure of the priced risk premium that is implicit in stock prices. Using the price-to-book decomposition by Vuolteenaho (2001, 2002), they derive a priced risk premium measure based on the sum of discounted simple expected future returns, which they proxy using future S&P 500 market index realized returns. In addition to examining the explanatory power of accounting beta, they conduct a portfolio analysis of the magnitude of the accounting beta valuation errors measured as the residuals from regressions of the priced risk premium on accounting beta. Cohen et al. (2009) provide evidence that accounting betas provide significant explanatory power for returns and also yield, on average, smaller valuation errors than stock returns betas. They find that the difference is particulary acute over longer realized return measurement horizons for the priced risk premium, such as a 5-year future realized returns window.

The stock returns-based risk premium model imposes two key assumptions. First, it assumes that the expected rate of return is a linear function of the risk-free rate and a constant risk premium. Second, it assumes clean surplus accounting. A strength of the model is that it indirectly relaxes assumptions regarding investors' choice of a valuation model. If investors' valuations diverge significantly from valuation models that are based on the residual income model, then a simple stock returns-based model of priced risk might improve the analysis of an association between risk estimates and priced risk. However, the model also introduces potentially serious drawbacks that have yet to be examined by the literature. Future realized returns include not only investors' expected rates of return, but also investors' revisions in expected future cash flows. If unexpected cash flow news is insignificant or unsystematic, a returns-based model will reasonably proxy for expected rates of return. However, if unexpected earnings news is systematic, it potentially introduces an omitted correlated variable to the analysis if left uncontrolled. The findings of Cohen et al. (2009), rather than providing evidence that accounting beta is a good risk estimate, might provide evidence that accounting beta is positively associated with unexpected earnings news, which might be associated with the accounting used to estimate the model.

Nekrasov and Shroff (2009) derive a slightly altered version of accounting beta directly from the residual income model. Following Baginski and Wahlen (2003), they estimate an implicit priced risk premium using a residual income valuation that they discount using only a risk-free rate. In contrast to Baginski and Wahlen (2003), they find evidence that accounting beta provides significant explanatory power over stock returns beta and the Fama and French (1992, 1993) risk factors.

The recent evidence for accounting beta suggests that, on average, accounting betas are superior to stock returns betas based on their finding that accounting beta risk measures better estimate the risk that is implied by market prices. Moreover, they find that accounting betas explain the value-to-growth equity risk premium documented by prior literature, suggesting that the premium might represent compensation for risk that is not adequately controlled for via stock returns beta. These results suggest that accounting beta might be a superior risk measure on average, but the extant research does not examine whether predictable settings exist in which stock returns beta is superior to accounting beta, and vice versa.

Accounting-based risk measures are functions of not only risk but also of the accounting methods used to derive the accounting inputs. To the extent accounting inputs are derived using imprecise accounting methods, accounting-based risk measures that rely on those estimates might generate similarly imprecise risk estimates. In these settings, stock returns-based estimates might have an information advantage if stock returns impound all value-relevant information. Potential accounting distortions might include arbitrary accounting methods such as straight-line depreciation or they might include intended distortions such as earnings management. To my knowledge, research has not yet examined whether there exist identifiable systematic distortions in accounting betas that lead to predictable settings where stock returns betas are, on average, superior risk estimates over accounting betas.

2.3 Summary

The CAPM's empirical problems might reflect the model's theoretical failings, the result of many simplifying assumptions, or the difficulties of implementing legitimate tests of the model. Yet, recent evidence for accounting betas provides some evidence of overcoming the problems with stock returns beta. Despite the CAPM's shortcomings, it remains one of the most widely used risk measures in both research and practice (Fama & French, 2004; Graham & Harvey, 2001). The attraction to the CAPM is due to its simple implementation and rather intuitive theoretical interpretation. For valuation, Feltham and Ohlson (1999) advocate using risk measures based on the nondiversifiable variability inherent in a firm's expected future residual income. Overall, the evidence suggests that the CAPM remains a relevant risk estimation method for valuation. Therefore, for an examination of how conservative accounting might distort investor's risk assessments, an analysis of acccounting beta also seems appropriate.

CHAPTER 3

ACCOUNTING BETA AND ACCOUNTING CONSERVATISM

Prior literature suggests that accounting beta is an, on average, superior risk estimate to stock returns beta, but it does not examine whether predictable settings might exist in which a stock returns-based measure is superior to an accounting-based measure, and vice versa. I investigate this issue. Specifically, I examine whether a characteristic of firms' accounting policies (i.e., accounting conservatism) and economic environment (i.e., growth) cause the relevant properties of earnings to be less effective at capturing risk. In considering the source of measurement distortion in both accounting and stock returns betas, it may be useful to consider the source of accounting and stock returns data in general. Since accounting data are a function of the accounting policies of a firm, errors in the accounting data are likely associated with firms' accounting policies. Although financial markets use accounting data to value firms' equity, the markets might correct accounting data errors during valuation. However, the process of valuation might also introduce new errors into stock returns. As a result, the question of whether identifiable contexts exist in which one measure is superior to the other is an empirical question.

Penman (2010a) suggests that if accounting rates of return are negatively associated with combined accounting conservatism and past investment growth, then during broad economic expansion, the cross-sectional differences in firms' accounting conservatism might cause accounting betas to underestimate a firm's risk. The average firm's investment growth broadly follows economic cycles (Stock & Watson, 1999). Prior research shows that past investment growth combines with conservative accounting to reduce a firm's ROE (e.g., Greenball, 1969; Penman & Zhang, 2002; Rajan et al., 2007). If the ROE of firms having unbiased accounting moves, on average, with the market, then, all else equal, a conservative accounting firm's ROE will have a diminished covariance with the ROE of a firm with unbiased accounting. The conservative accounting firm will, on average, have a smaller ROE during economic expansion and a larger ROE during economic contraction than the unbiased accounting firm. The reduced covariance would generate smaller accounting betas for firms with more conservative accounting during periods of changing economic growth so that firms with more conservative accounting would appear less risky even if the difference between the firms was largely due to their accounting.

The above suggests that, in certain economic contexts, the combined effects of accounting conservatism and past investment growth might reduce the effectiveness of accounting betas for firms with more conservative accounting. Accordingly, I examine the impact of accounting conservatism and past investment growth on the ability of accounting betas to generate smaller valuation errors relative to stock returns beta.

I examine the differences between the valuation errors for accounting beta and stock returns beta. By comparing the valuation errors of accounting beta to stock returns beta, I indirectly control for other information included in market portfolio returns that is uncorrelated with either accounting beta or stock returns beta. Thus, examining the association between the differences in the residuals and both accounting conservatism and past investment growth should provide a clearer analysis of the risk measurement differences between accounting beta and stock returns beta. Following Cohen et al. (2009), I estimate valuation errors as the residuals from ordinary least squares (OLS) regressions of discounted simple future realized market portfolio stock returns on either accounting beta or stock returns beta.

Examining the valuation error differences between accounting beta and stock returns beta provides evidence of the measurement distortion in accounting betas related to accounting conservatism. An examination of the differences also investigates whether one risk measure is superior in such settings. If stock returns betas are less vulnerable to the impact of accounting conservatism and if they are reasonable proxies for risk in their own right, I predict that their valuation errors will be smaller than those of accounting-based risk measures for conservative accounting firms during periods of broad economic growth or contraction.[1]

In this chapter, I begin my analysis by first providing a more detailed description of my hypotheses for accounting conservatism, investment growth, and accounting betas. I next describe my empirical test design, including sample selection and variable measurement choices. I then conduct the primary tests of my hypotheses. I delay sensitivity and

[1]Stock returns might be similarly affected by conservatism and past investment changes. Penman and Zhang (2002) document evidence that investors fail to immediately adjust for the ROE distortion caused by accounting conservatism and investment growth so that they incorporate the distortion into prices and subsequent returns.

robustness analyses until Chapters 4 and 5. I end this chapter with a brief discussion of my primary results.

3.1 Hypothesis Development

The CAPM defines risk as the covariance between an asset's expected returns and the expected returns on the market, but the CAPM is typically estimated using past realized returns to proxy for expected future returns. For example, stock returns betas are estimated using past realized stock returns to proxy for expected future returns, while accounting betas are estimated using past realized accounting rates of return (typically the return on common equity (ROE)) to proxy for expected future returns.

If realized stock returns and reported ROE are reasonable proxies for expected asset returns, then both stock returns-based and accounting-based risk estimates conform to original CAPM theory, and either risk-estimate should adequately measure risk. This is not likely the case, however, since both estimates are based on models that use imperfect proxies for expected future returns. This suggests that both measures are potentially inadequate or that the relative superiority of one measure over the other might be contextual.

For the latter situation to be descriptive, two conditions must hold. First, measurement error in the two types of risk estimates must not be perfectly correlated. Second, it must be possible to identify observable contexts in which one of the risk measures is expected to be superior to the alternative. In this study, I restrict my analysis to a single source of measurement distortion, conservative accounting, where I feel that the difference between the two measures is likely significant and where the distortion can be reasonably estimated by commonly used proxies.[2]

3.1.1 Conservatism, Growth, and Accounting Rates of Return

I adopt the definition of conservatism provided by Gjesdal (2004). Accounting is conservative if it records investments at a carrying value that yields an accounting rate of return

[2]Specifically, I examine unconditional accounting conservatism as motivated by the theoretical analysis of Rajan et al. (2007). Future research might examine distortions related to conditional accounting conservatism or even distortions that are introduced through management reporting discretion including earnings management. By focusing on unconditional accounting conservatism, I limit my analysis to examining a distortion potentially introduced by public accounting standards, specifically one based on conservative accounting policies. Although the distortion of accounting-based risk measures due to management discretion in earnings is perhaps less controversial, it may be more difficult to measure and predict. By limiting the scope of my analysis to examine only conservative accounting practices that are specifically required by accounting standards and that require little manager or auditor judgment, I provide evidence on the consequences of conservative accounting policies on risk assessment.

greater than the internal rate of return based on the investments' cost. Prior literature extensively documents the systematic association between conservative accounting and accounting rates of return (e.g., Beaver & Ryan, 2000; Greenball, 1969; Penman & Zhang, 2002). Like the prior literature, Rajan et al. (2007) model the association and find that accounting rates of return are higher (lower) than the internal rate of return on an investment when accounting is conservative and the firm's investment growth rate is less (greater) than the internal rate of return.[3] They extend this result to find a negative association between accounting rates of return and the combined interaction between accounting conservatism and past investment growth over the average useful life of a firm's assets.

(Rajan et al., 2007) model an investment's useful life as the relevant period for analyzing the joint effects of accounting conservatism and investment growth on accounting rates of return. They assume geometric investment depreciation so that each year's depreciation expense is equal to or less than the previous year's depreciation expense. Both straight-line depreciation and the immediate expensing of investments satisfy this criterion. They also assume uniform investment cash flows and suggest that this assumption might correspond to a setting where new investments result in fixed production capacity for a firm.

With these additional assumptions, the model of Rajan et al. (2007) predicts that conservative accounting and past investment growth are "substitutes" in their joint impact on accounting rates of return. Given accounting conservatism, an increase in past investment growth reduces ROE and magnifies the effect of any further increase in investment growth on ROE, and vice versa. Given past investment growth, an increase in accounting conservatism reduces ROE and magnifies the effect of any futher increase in accounting conservatism on ROE. Thus, the combination of accounting conservatism and past investment growth is negatively associated with accounting rates of return. In empirical tests of their model, Rajan et al. (2007) find support for the negative cross-partial interaction between accounting rates of return and both accounting conservatism and average past investment growth. I provide a demonstration of their model's findings in the Appendix.

3.1.2 Conservatism, the Absolute Value of Past Investment Growth, and Accounting Betas

Penman (2010a) suggests that accounting conservatism, when combined with investment growth, might cause accounting betas to understate firm risk in the presence of marketwide economic growth. The findings of Rajan et al. (2007) findings suggest that compared to a

[3] Liberal or aggressive accounting reverses the prediction.

firm with unbiased accounting, the ROE of an identical firm having conservative accounting will be smaller during periods of increasing past investment growth and larger during periods of decreasing past investment growth. Conservative accounting diminishes the covariance between the two firms.

For the negative covariance effect to broadly apply to the ROE covariance between a conservative accounting firm and the market portfolio, I make two additional assumptions. First, I assume that, on average, a firm's investment rate tends to be procyclical with the economy (Stock & Watson, 1999).[4] Second, I assume an on average positive correlation between firm and market performance. If the ROE of a firm that grows investments subject to neutral accounting treatment rises and falls, on average, with the market, then the ROE of a firm that grows investments subject to more conservative accounting treatment might appear diminished relative to marketwide ROE due to the interactive effects between conservative accounting and past investment growth. If firms' accounting conservatism varies cross-sectionally, then, during periods of varying investment growth, I predict that firms having more conservative accounting treatment will have systematically smaller accounting betas than firms having less conservative (more neutral) accounting. Specifically, I hypothesize that:

H1: *Accounting beta is negatively associated with conservative accounting and the absolute value of past investment growth.*

I hypothesize that accounting beta is negatively associated with the joint effect of conservative accounting and the absolute value of past investment growth. Because accounting rates of return are negatively associated with the joint effect of accounting conservatism and past investment growth, as investment growth increases (decreases), accounting rates of return decrease (increase) (Rajan et al., 2007). The covariance between the ROE of a firm having unbiased accounting treatment and the ROE of a firm having conservative accounting treatment is diminished as the investment in both firms either grows or contracts. I therefore predict that accounting beta is negatively associated with accounting conservatism and the absolute value of past investment growth.

Although Cohen et al. (2009) and Nekrasov and Shroff (2009) document evidence that

---

[4]Fama and French (1997) provide suggestive evidence that many industries' abnormal returns positively covary with the market's abnormal returns. They estimate beta for 59 industry portfolios and document that beta is positive across each portfolio. Their findings might also suggest a general investment procyclicality across major industries. Combining their findings with the findings of Stock and Watson (1999), I generally assume broad procyclical growth among firms.

accounting betas produce valuations with smaller valuation errors than stock returns betas, the predicted systematic cross-sectional variation in firms' accounting betas suggests that firms having more conservative accounting and greater absolute past investment growth are more likely to have greater valuation errors. It also suggests a context where stock returns beta might be a superior risk estimate to accounting beta. I therefore predict the following:

H2: *The on average difference between accounting beta valuation errors and stock returns beta valuation errors is positively associated with accounting conservatism and the absolute value of past investment growth.*

3.2 Test Design

I test the predicted negative association between accounting beta and both conservative accounting and the absolute value of past investment growth using the following panel regression:

$$\beta_{it}^{roe} = \gamma_0 + \gamma_1 Conservatism_{it} + \gamma_2 |PInvest_{it}| + \gamma_3 Conservatism_{it} * |PInvest_{it}| + \gamma_4 Risk_{it} + \xi_{it}. \quad (3.1)$$

Equation (3.1) describes accounting beta (β_{it}^{roe}) as a function of the firm's conservatism ($Conservatism_{it}$), the absolute value of its past investment growth ($|PInvest_{it}|$), and risk ($Risk_{it}$). H1 predicts that accounting beta is negatively associated with the joint effect of both conservative accounting and past investment changes ($Conservatism_{it} * |PInvest_{it}|$). Accordingly, I predict that γ_3 is negative.

In Equation (3.1), I include the noninteracted terms for conservatism and past investment changes to provide a more complete econometric specification. I include a control for risk because I predict that accounting beta is a function of both a firm's idiosyncratic fundamental risk and its conservative accounting policy. Omitting risk from the regression might bias γ_3 upward since I predict a positive assocation between accounting beta and stock returns beta, as well as stock returns beta, conservative accounting, and past investment growth.[5] In the context of distortion due to accounting conservatism and past investment changes, a good instrumental variable for risk will be uncorrelated with the accounting distortion. I use stock returns beta (β_{it}^{ret}) to estimate risk in Equation (3.1). Although

[5] Conservatism might be correlated with risk because Generally Accepted Accounting Principles (GAAP) frequently require conservative accounting treatment in situations where accounting measurement is difficult or highly uncertain. Further, growth might be correlated with risk because by definition it leads to performance instability and, if anticipated, it is associated with more uncertain forecasts of future firm performance (Beaver et al., 1970; La Porta, 1996).

stock returns beta should be correlated with the risk components of both growth and conservatism, I do not expect it to be correlated with the accounting distortion. I predict γ_4 will be positive and significant.

My next tests examine the valuation errors for accounting beta and stock returns beta risk measures. Following Cohen et al. (2009), I examine the valuation errors of risk estimates using a set of measures they refer to as price-level alphas.[6] Cohen et al. (2009) motivate price-level alphas from a market-to-book decomposition by Cohen et al. (2003) and Vuolteenaho (2002) where, to a very close approximation,

$$log\left(\frac{ME_{t-1}}{BE_{t-1}}\right) = \sum_{j=1}^{\infty} \rho^j log(1 + ROE_{t+j}) - \sum_{j=1}^{\infty} \rho^j log(1 + Ret_{t+j}). \tag{3.2}$$

In Equation (3.2), ME_{t-1}/BE_{t-1} denotes the market-to-book equity ratio and Ret_{t+j} denotes the net expected future market returns on a firm's stock.

Over an infinite horizon, or a finite horizon that captures the life of a firm, both accounting ROE and market returns should equal. Although over finite horizons the two measures might differ, any distortions eventually must reverse. Consistent with this equivalence hypothesis, the decomposition in Equation (3.2) suggests that over an infinite horizon, the market-to-book ratio is equal to one because the total accounting return realizations must equal the total market return realizations. Over shorter horizons, the discounted sum of ROE and the discounted sum of stock returns might differ along with their separate covariations with a common risk factor. Cohen et al. (2009) contend that the difference might be due to measurement error, or mispricing, in stock returns. I extend their analysis to examine whether the difference is also due to measurement error in a firm's accounting rates of return that is related to accounting conservatism.

Cohen et al. (2009) rearrange Equation (3.2) and take the conditional expectation to express the log-linear difference between market value and fundamental value as a function of market price:

$$\left[logBE_{t-1} + \sum_{j=1}^{\infty} \rho^j E_{t-1} log(1 + ROE_{t+j})\right] - logME_{t-1} = \sum_{j=1}^{\infty} \rho^j E_{t-1} log(1+R_{t+j}). \tag{3.3}$$

They refer to the right-hand side as the price-level, which is equal to the discounted long-horizon sum of expected future returns.

[6]In Chapter 5, I examine valuation errors estimated by regressing an implied cost of equity capital measure on risk estimates for either accounting beta or stock returns beta.

Assuming the price-level can be expressed as a linear function of the risk-free rate, a constant risk premium, and a valuation error, Cohen et al. (2009) model the price-level as

$$\hat{E}(Ret_t^N) = \gamma_0 + \gamma_1 Risk_{i,t} + \upsilon_{i,t}. \tag{3.4}$$

In the equation, $\hat{E}(Ret_t^N)$ is the discounted N-year ahead expected market return at time t, $Risk_{i,t}$ is either accounting beta or stock returns beta, and $\upsilon_{i,t}$ is the price-level alpha used to estimate the precision for each risk measure. In my analysis, I use the S&P 500 returns to proxy the expected market return and I follow Cohen et al. (2009) to estimate $\hat{E}(Ret_t^N)$ as a discounted yearly simple compound holding period return of up to 5 years in the future. I assume a constant discount rate equal to 2.5%.[7]

The risk-return model in Equation (3.4) assumes that future realized market returns are comprised predominantly of returns related to risk. Prior literature, however, suggests that future realized market returns also contain a significant portion of returns due to investors' changing expectations about future cash flows (Easton & Monahan, 2005; Vuolteenaho, 2002). Thus, a simple analysis of the regression residuals might more closely correspond to an analysis of the investors' changing cash flow expectations rather than to an analysis of the risk-relevance of accounting betas or stock returns betas. To overcome this potential limitation, I examine the differences between the valuation errors for accounting beta and stock returns beta.[8]

By comparing the valuation errors of accounting beta to stock returns beta, I indirectly control for other information that is impounded into returns. To the extent that the other information is uncorrelated with either risk measure, the information should be equally present in the regression residuals generated from either model. The differences between the residuals should then capture only the valuation error differences that are associated with risk measurement differences between accounting beta and stock returns beta.

To test whether accounting conservatism provides a setting where stock returns betas are more precise risk measures than accounting betas, I sort firm-years into two-dimensional quintile portfolios for conservatism and past investment changes and examine the mean

---

[7] Cohen et al. (2009) proxy expected market returns using a sample average of discounted future returns at time t. To remain consistent with the empirical market definition I use to calculate betas, I calculate average returns from the S&P 500.

[8] Controlling for changing investors' expectations is especially important if investors initially fail to fully unwind the effects of conservatism and growth on ROE as suggested by Penman and Zhang (2002). In that context, I would expect to observe a negative association between accounting beta regression residuals and both conservatism and investment growth either because investors initially overestimated future ROE or because they initially underestimated risk. Without including control variables to capture investors' updated expectations, I am unable to distinguish between these two possibilities.

differences between the price-level alphas for accounting beta and stock returns beta. For H2, I predict an increasing positive difference between price-level alphas for accounting and stock returns betas over sorts for conservatism and average past investment changes. Specifically, I predict a significant positive difference between the portfolio having the highest rankings for conservatism and average past investment changes and the portfolio having the lowest rankings for the two measures.

3.2.1 Sample Selection

My sample of firms comprises the intersection between CRSP and Compustat firm data over the period 1980-2010. Table 3.1 summarizes my sample formation.

I collect all annual financial accounting data from Compustat, excluding financial industry firms that have SIC codes between 6000 and 6999 and firms not having information on CRSP. [9] My dataset is limited to observations having sufficient information to derive ROE and my proxies for conservative accounting and the absolute value of past investment growth. For ROE, I require that firms have reported values for pretax income and prior book equity. For the conservative accounting and absolute value of past investment growth proxies, I require that firms report positive gross property plant and equipment and positive depreciation expense.

I also exclude from my sample firm-year observations having an insufficient time-series of ROE and stock returns data to estimate accounting beta and stock returns beta, respectively. I obtain monthly returns data from CRSP. For accounting beta, I require that firms have sufficient data to calculate ROE for the 10 consecutive years prior to the risk assessment date which I set at 4 months after the fiscal year-end.. For stock returns beta, I require that each firm-year have 5 consecutive years of monthly returns data prior to the risk assessment date. I use the constituents of the S&P 500 Index to proxy for the market portfolios used to estimate accounting betas and stock returns betas. I obtain index constituent data from the Compustat Index Constituents table. I use the index constituent data to also form monthly value-weighted portfolios of stock returns and ROE.[10] For excess returns calcuations, I also collect monthly 10-year treasury bond yields from the Federal Reserve Statistical Release historical database.

To complete the sample restrictions, I require that each firm-year observation have sufficient data to calculate a minimum of 1-year ahead simple compound returns for the

[9] In untabulated analyses, I remove the SIC industry restriction and find statistically similar results.

[10] I do not exclude financial industry firms from the market portfolio.

Table 3.1: Sample Formation (Sample Period 1980–2010)

	Firm-Years	Firms
All Compustat firm-year observations	426,309	32,837
Less firm-year observations:		
Having SIC codes between 6000 and 6999	132,555	751
Without matching data on CRSP	50,397	9,084
Having insufficient data for ROE, conservatism, and growth	152,886	12,858
Having insufficient data to derive accounting beta	51,982	5,566
Having insufficient data to derive stock returns beta	3,346	319
Having less than one full year of future S&P returns	1,672	143
	33,471	4,116

Notes: The table summarizes my sample selection criteria.

S&P 500 Index using the consecutive 12 months of realized stock returns data after the risk assessment date. I use the future realized return data to estimate price-level alphas for the beta measures. My final sample has 33,471 firm-years with 4,116 distinct firms.

3.2.2 Risk Measures

I estimate stock returns beta (β_{it}^{ret}) as the slope coefficient from a regression of a firm's excess market returns on the excess market returns of the S&P 500 Index:

$$(R_{it} - R_{ft}) = \alpha_i + \beta_i(R_{mt} - R_{ft}) + \varepsilon_{it}. \tag{3.5}$$

I estimate the regression over the 60 consecutive months prior to the risk assessment date. For the risk-free rate, I use the de-annualized monthly reported yield from a 10-year treasury bond.

I follow a similar approach to estimate accounting beta (β_{it}^{roe}) as the slope coefficient from a yearly regression of a firm's excess ROE on the excess ROE from a market portfolio:

$$(ROE_{it} - R_{ft}) = \alpha_i + \beta_i(ROE_{mt} - R_{ft}) + \varepsilon_{it}. \tag{3.6}$$

I construct a monthly value-weighted market portfolio of ROE by calculating each month the value-weighted average of the S&P 500 constituent firms' most recently reported ROE.[11] I estimate Equation (3.6) for each firm-year using the firm's prior 10 consecutive yearly

[11] I follow common practice by using the S&P 500 index to proxy for the market portfolio (Campbell et al., 1997). Prior research suggests that CAPM estimates are relatively insensitive to market portfolio selection to the extent the portfolio is highly correlated with the market (Stambaugh, 1982; Kandel & Stambaugh, 1987; Shanken, 1987). I also examine a value-weighted market portfolio based on the set of firms comprising the intersection between Compustat and CRSP firms. My results remain unchanged using the alternative portfolio.

observations of ROE data and market portfolio ROE that correspond to that year and month.

I calculate ROE as operating income after depreciation, interest expense, and interest income (Compustat data item *pi*) multiplied by one minus the marginal tax rate, all divided by lagged book equity (Compustat data item *ceq*). Since taxes may be relevant to the analysis, I adjust pretax income by a uniform yearly tax rate that follows those used by Nissim and Penman (2001). I exclude any observations where lagged book equity is nonpositive.

3.2.3 Conservatism and Growth Measures

Following Rajan et al. (2007), I measure conservatism as R&D plus advertising expenses divided by total investments, where total investments is the sum of R&D, advertising, and capital expenditures (Compustat data items *xad*, *xrd*, and *capxv*, respectively). An advantage of this measure is that it abstracts managerial manipulation from permanent conservative accounting policy by focusing on R&D expenditures ($R\&DExp_{it}$) and advertising expenditures ($AdvExp_{it}$) that are less subject to management's reporting discretion. By removing the potential for management-induced conservatism, I am able to restrict my analysis to the effects of conservatism motivated by accounting standards without having to consider managers' motives and the market's potential responses.

Following Rajan et al. (2007), the relevant past investment growth corresponds to the average useful life of a firm's conservatively held assets. They estimate past growth by calculating the geometric average of a firm's total investment growth over the prior years corresponding to the estimated average useful life of the firm's assets. Each period, Rajan et al. (2007) estimate growth in total investment as $[(TotalInvestments_t/TotalInvestments_{t-1}) - 1]$, and they estimate average useful life by dividing the firm's current gross property, plant, and equipment (Compustat data item *ppegt*) by the current-year depreciation expense (Compustat data item *dpc*).

For conservative accounting firms, I expect that both positive and negative percentage changes in investment will reduce the covariance between a firm's excess ROE and the excess ROE on the market. I therefore calculate the absolute value of the geometric average of past investment growth over the estimated average useful life of a firm's assets. I refer to this measure as the absolute value of a firm's past investment growth at time t ($|PInvest_{it}|$).

3.2.4 Descriptive Statistics

Table 3.2 provides descriptive statistics for my key empirical proxies. As expected, stock returns beta has a mean close to one. Accounting beta, however, does not. It has a mean equal to 0.421. Although less than one, the mean is consistent with the descriptive statistics of Nekrasov and Shroff (2009). Further, it might indicate that my final sample is predominantly comprised of firms having more conservative accounting than the average firm within the S&P 500 Index. Consistent with this, the average conservatism among the set of S&P 500 firms is 0.172. The median also suggests accounting beta may be negatively distorted since the data appear to be right-skewed so that the left tail of the sample distribution shows increased frequency clustered near the mean. The sample average for conservatism is 0.484, suggesting the sample is comprised of firms having a large proportion of total investment in R&D and advertising. The average absolute value of past investment growth is 13.5%.

I examine the correlations between my key empirical proxies in Table 3.3. Consistent with prior literature, the correlations between accounting beta and stock returns beta are quite low. Baginski and Wahlen (2003) examine year-by-year correlations between accounting beta and stock returns beta and find that the Spearman correlations range from 0.06 to 0.11 over the period 1990 to 1998. I find similar results.

Table 3.2: Descriptive Statistics

			Percentiles		
Variables	Mean	Std. Dev.	25	50	75
β_{it}^{roe}	0.421	2.162	-0.288	0.181	1.175
β_{it}^{ret}	1.060	0.684	0.649	1.005	1.383
$Conservatism_{it}$	0.484	0.273	0.258	0.477	0.708
$\lvert PInvest_{it}\rvert$	0.135	0.135	0.049	0.102	0.180
$Conservatism_{it} * \lvert PInvest_{it}\rvert$	0.052	0.102	0.006	0.032	0.076

Notes: The table presents descriptive statistics for my primary empirical proxies. Accounting beta (β_{it}^{roe}) is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on estimated excess market portfolio ROE. Stock returns beta (β_{it}^{ret}) is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. I use the S&P 500 index as a market portfolio proxy. Accounting conservatism ($Conservatism_{it}$) equals R&D plus advertising expenses divided by total investments. The absolute value of past investment growth ($|PInvest_{it}|$) is the geometric average of past total investment growth over the estimated average useful life of a firm's assets, where average useful life equals current gross property, plant, and equipment divided by current depreciation expense.

Table 3.3: Correlation Statistics (Pearson\Spearman)

Variables	β_{it}^{roe}	β_{it}^{ret}	$Conservatism_{it}$	$\lvert PInvest_{it}\rvert$	$Conservatism_{it} * \lvert PInvest_{it}\rvert$
β_{it}^{roe}	1.000	0.087	-0.085	0.035	-0.020
β_{it}^{ret}	0.038	1.000	0.108	0.160	0.168
$Conservatism_{it}$	-0.084	0.138	1.000	-0.027	0.566
$\lvert PInvest_{it}\rvert$	-0.003	0.122	0.010	1.000	0.745
$Conservatism_{it} * \lvert PInvest_{it}\rvert$	-0.049	0.133	0.419	0.800	1.000

Notes: The table presents correlation statistics for my primary empirical proxies. The upper-right table statistics are Spearman correlations, the lower-left statistics are Pearson correlations. Accounting beta (β_{it}^{roe}) is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on estimated excess market portfolio ROE. Stock returns beta (β_{it}^{ret}) is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. Accounting conservatism ($Conservatism_{it}$) equals R&D plus advertising expenses divided by total investments. The absolute value of past investment growth ($|PInvest_{it}|$) is the geometric average of past total investment growth over the estimated average useful life of a firm's assets, where average useful life equals current gross property, plant, and equipment divided by current depreciation expense. Price-level ($\hat{E}(Ret_t^N)$) equals the simple discounted 1-year-ahead monthly market portfolio returns. I use the S&P 500 index as a market portfolio proxy.

Table 3.3 shows that stock returns beta is positively correlated and accounting beta is negatively correlated with accounting conservatism and the absolute value of past investment growth, including the interaction between the two measures. The negative correlation between accounting betas and accounting conservatism and the absolute value of past investment growth is consistent with my hypotheses. The positive correlation between stock returns betas and accounting conservatism might be consistent with the uncertainty inherent in R&D and advertising expenditures that motivated accounting standards to require that they be immediately expensed. Investment growth is also inherently risky, potentially explaining the positive correlation observed between stock returns beta and the absolute value of past investment growth.

3.3 Primary Tests and Results

Table 3.4 summarizes the results of testing for an association between accounting beta and proxies for accounting conservatism and the absolute value of past investment growth. Consistent with Hypothesis 1, I find a significant negative association between accounting beta and the interaction between accounting conservatism and the absolute value of past investment growth. The association remains significant even after including stock returns beta to control for risk. I also find a strong negative coefficient for conservatism alone, and a strong positive coefficient for the absolute value of past investment growth.[12]

For the regression model that controls for risk, the interaction coefficient suggests that, ceteris paribus, a 1% increase in the proportion of current period conservatively reported investments (i.e., investments that are expensed immediately) relative to total investments reduces the amount of variance that firm i contributes to market variance by approximately 0.006 plus 0.016 multiplied by the firm's average absolute past investment growth rate. For a firm having an average absolute past investment growth rate equal to approximately 14%, a 1% increase in the proportion of conservative investments decreases the variance contributed to the market ROE variance by 0.009. Similarly, a 1% increase in the firm's average absolute past investment growth rate contributes to market portfolio ROE variance by approximately 0.007, less 0.016, multiplied by the firm's proportion of conservative investment. For a firm having an average proportion of conservative investment equal to approximately 48%, a 1% increase in the firm's average absolute past investment growth rate

[12] Although this might suggest that accounting conservatism and investment growth each have independent effects on accounting betas, the finding might also reflect my narrowly defined measure of conservatism where the omitted components of conservatism and growth are more strongly correlated with the independent measures.

Table 3.4: Accounting Beta Regressions

$\beta_{it}^{roe} = \gamma_0 + \gamma_1 Conservatism_{it} + \gamma_2 \lvert PInvest_{it}\rvert + \gamma_3 Conservatism_{it} * \lvert PInvest_{it}\rvert + \gamma_4 \beta_{it}^{ret} + \varepsilon_{it}$		
Intercept	0.658**	0.509**
	(15.503)	(11.193)
$Conservatism_{it}$	-0.555**	-0.643**
	(-7.664)	(-8.812)
$\lvert PInvest_{it}\rvert$	0.944**	0.742**
	(4.261)	(3.334)
$Conservatism_{i,t} * \lvert PInvest_{i,t}\rvert$	-1.797**	-1.645**
	(-5.095)	(-4.663)
β_{it}^{ret}	-	0.196**
	-	(9.101)
$Adj.R^2$	0.008	0.010

Notes: This table presents the results of panel data regressions of accounting beta (β_{it}^{roe}) on accounting conservatism ($Conservatism_{it}$), absolute past investment growth ($|PInvest_{it}|$), and stock returns beta (β_{it}^{ret}). β_{it}^{roe} is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on estimated excess market portfolio ROE. β_{it}^{ret} is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. I use the S&P 500 index as a market portfolio proxy. $Conservatism_{it}$ equals R&D and advertising expenses divided by total investments. $|PInvest_{it}|$ is the geometric average of past total investment growth over the estimated average useful life of a firm's assets, where average useful life equals current gross property, plant, and equipment divided by current depreciation expense. ** indicates significance with $p < 0.01$.

reduces market portfolio ROE variance by approximately 0.001. Therefore, if a firm with average conservatism similarly has average absolute past investment growth, the net effect on the firm's contribution to market portfolio ROE variance is approximately -0.32, ceteris paribus. The net effect is negative and is related to the hypothesized negative distortion associated with a firm's conservative accounting.

My findings for Hypothesis 1 support two possible interpretations. First, firms using more conservative accounting policies might be less risky than firms using less conservative accounting policies during periods of economic expansion or contraction.[13] Alternatively,

[13]Because my proxy for conservatism is based upon two types of investments for which GAAP requires immediate expensing, this first interpretation might seem unlikely. The required immediate expensing of R&D and advertising expenses is motivated by the large degree of uncertainty related to the cash flows generated by these investments. Instead of decreasing risk, GAAP suggests the proportion of immediately expensed investments should be positively associated with risk.

the impact of accounting conservatism on ROE during periods of economic expansion or contraction might distort the covariance between firm ROE and market ROE, causing firms with more conservative accounting to appear less risky when using accounting-based risk measures. To distinguish between these alternative interpretations, I examine and compare the valuation errors for both accounting betas and stock returns betas.

Table 3.5 presents the results of the regression estimates of valuation errors for accounting beta and stock returns beta. Panel A presents the regression results for estimating the valuation errors for accounting beta and Panel B presents the results for estimating the valuation errors for stock returns beta. As expected, the coefficients on accounting beta and stock returns beta are consistently positive for all market return horizons. Although the coefficient on stock returns beta appears larger for each of the return horizons greater than 1 year, the adjusted R^2 is smaller for stock returns betas for all but the 5-year return horizon. The higher adjusted R^2 for accounting beta is consistent with the conclusion from the more recent literature that suggests that accounting betas have stronger explanatory power for future returns (Cohen et al., 2009).

I next examine the association between accounting beta valuation errors and accounting conservatism and the absolute value of past investment growth. Rather than examine the association directly, I examine the valuation error differences between accounting betas and stock returns betas sorted by both accounting conservatism and the absolute value of past investment growth. Because I do not control for investors' cash flow revisions while estimating the price-level alphas for accounting beta and stock returns beta, price-level alphas likely contain returns components associated with investors' cash flow revisions. I focus my analysis on the expected returns component implicit in future realized returns by differencing the valuation errors between accounting betas and stock returns betas.[14] Table 3.6 presents the portfolio tests of these differences, sorted by accounting conservatism and average past investment changes. I present only the results from regressions over the 1-year and 5-year realized market returns horizons, but the untabulated results for regressions over 24- and 36-month horizons yield similar results.

Hypothesis 2 predicts that the price-level alpha differences for accounting and stock returns beta will be increasing in both conservatism and average past investment changes. Table 3.6 documents a mostly consistent positive trend across portfolios of increasing conservatism and growth, especially along the diagonal, for both the 1-year and 5-year

---

[14]In Chapter 5, I re-examine these results while attempting to control for investors' cash flow revisions and other returns components more directly within the valuation error estimation regressions.

Table 3.5: Valuation Error (Price-Level Alpha) Estimation

Panel A: Price-Level Alpha Estimation for Accounting Beta

$$\hat{E}\sum_{j=1}^{N}\rho^{j}Ret_{t+j} = \gamma_0 + \gamma_1\beta^{roe}_{i,t} + \upsilon^{roe}_{it}$$

N	γ_0	γ_1	Adj. R^2
1	0.108**	0.003**	0.002
	(102.802)	(7.496)	
2	0.232**	0.005**	0.002
	(151.891)	(7.225)	
3	0.348**	0.006**	0.002
	(162.753)	(6.499)	
5	0.557**	0.012**	0.003
	(164.613)	(8.169)	

Panel B: Price-Level Alpha Estimation for Stock Returns Beta

$$\hat{E}\sum_{j=1}^{N}\rho^{j}Ret_{t+j} = \gamma_0 + \gamma_1\beta^{ret}_{i,t} + \upsilon^{ret}_{it}$$

N	γ_0	γ_1	Adj. R^2
1	0.109**	0.001	0.000
	(55.594)	(0.731)	
2	0.228**	0.007**	0.000
	(80.216)	(2.852)	
3	0.341**	0.010**	0.000
	(86.005)	(2.847)	
5	0.512**	0.051**	0.003
	(81.585)	(9.568)	

The table presents the estimation of the valuation errors for accounting beta (Panel A) and stock returns beta (Panel B). The valuation errors are the price-level alphas (υ^{roe}_{it}) estimated as the residuals from regressions of average market portfolio N-year discounted simple returns on each of the beta measures, accounting beta (β^{roe}_{it}) and stock returns beta (β^{ret}_{it}). I use a constant discount rate ($1/\rho$) equal to 2.5%. I use the S&P 500 Index as the market portfolio. β^{roe}_{it} is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on estimated excess market portfolio ROE. β^{ret}_{it} is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. (t-values are in parentheses. ** indicates significance at $p < 0.01$.)

Table 3.6: Test of Differences in Price-Level Alphas

Panel A: 1-Year Price-Level Alpha Estimates

	$\upsilon_{it}^{roe} - \upsilon_{it}^{ret}$					
	$\lvert PInvest_{it} \rvert$					
$Conservatism_{it}$	1	2	3	4	5	$(5-1)$
1	-0.0003	-0.0002	-0.0002	-0.0006	-0.0002	0.0000
	(-2.43)	(-2.02)	(-1.69)	(-4.12)	(-1.66)	(0.22)
2	-0.0003	-0.0001	-0.0002	-0.0002	-0.0002	0.0000
	(-2.14)	(-1.13)	(-1.59)	(-1.51)	(-1.46)	(0.11)
3	0.0001	0.0000	0.0000	-0.0002	0.0000	-0.0001
	(0.42)	(-0.29)	(-0.30)	(-1.64)	(-0.06)	(-0.30)
4	0.0002	0.0003	0.0004	0.0004	0.0003	0.0000
	(1.66)	(1.96)	(2.53)	(2.80)	(1.34)	(0.08)
5	0.0011	0.0014	0.0010	0.0012	0.0016	0.0077
	(6.38)	(8.25)	(5.49)	(5.96)	(7.11)	(6.95)
$(5-1)$	0.0014	0.0017	0.0012	0.0018	0.0018	0.0019
	(6.68)	(7.93)	(5.47)	(7.25)	(6.88)	(7.43)

Table 3.6 – Continued...

Panel B: 5-Year Price-Level Alpha Estimates

	$\upsilon_{it}^{roe} - \upsilon_{it}^{ret}$					
	$\lvert PInvest_{it}\rvert$					
$Conservatism_{it}$	1	2	3	4	5	$(5-1)$
1	-0.0063	-0.0053	-0.0024	-0.0018	0.0026	0.0102
	(-12.91)	(-10.75)	(-5.13)	(-3.30)	(4.22)	(10.25)
2	-0.0057	-0.0040	-0.0023	-0.0013	0.0016	0.0107
	(-10.80)	(-8.27)	(-4.74)	(-2.74)	(2.67)	(11.36)
3	-0.0046	-0.0029	-0.0016	-0.0008	0.0033	0.0068
	(-7.95)	(-5.08)	(-3.06)	(-1.49)	(5.30)	(7.25)
4	-0.0033	-0.0012	-0.0002	0.0025	0.0053	0.0093
	(-4.80)	(-1.94)	(-0.39)	(4.03)	(7.34)	(8.70)
5	0.0039	0.0054	0.0044	0.0075	0.0103	0.0077
	(4.27)	(6.49)	(5.18)	(7.66)	(10.64)	(6.95)
$(5-1)$	0.0102	0.0107	0.007	0.0090	0.0077	0.0166
	(10.25)	(11.36)	(7.28)	(8.70)	(6.95)	(15.60)

Notes: This table presents the mean differences between price level alphas for accounting beta and stock returns beta across accounting conservatism ($Conservatism_{it}$) and absolute past investment growth ($\lvert PInvest_{it}\rvert$)quintiles. Price level alphas are the residuals from regressions of discounted average market returns on either accounting beta or stock returns beta. I discount average future market returns over 1-year and 5-year holding periods using a constant discount rate equal to 2.5%. I use the S&P 500 index as a market portfolio proxy. Accounting beta is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on the estimated excess market portfolio ROE. Stock returns beta is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. $Conservatism_{it}$ equals R&D and advertising expenses divided by total investments. $\lvert PInvest_{it}\rvert$ is the geometric average of past total investment growth over the estimated average useful life of a firm's assets, where average useful life equals current gross property, plant, and equipment divided by current depreciation expense. T-statistics are reported in parentheses. The t-statistics for the portfolio differences presented in the last row and last column assume unequal variances. The two numbers in the last row and last column evaluate the differences between the highest $Conservatism_{it}$ and $\lvert PInvest_{it}\rvert$ portfolio and the lowest $Conservatism_{it}$ and $\lvert PInvest_{it}\rvert$ portfolio.

horizons. I find that the positive trend is also strongest for longer horizon future realized return measurement periods. A formal test of the differences between the price-level alphas in the highest portfolio for conservatism and growth and the lowest portfolio for conservatism and growth among the 5-year horizon data yields a t-statistic of 15.60, which is highly significant in the expected direction. The difference is close to 2% of the average expected return, and suggests that conservative accounting policy, when combined with the absolute value of past investment growth, is associated with the magnitude of the valuation errors. It also suggests that stock returns betas provide a superior measure of risk over accounting betas when firms use more conservative accounting policies during periods of highly fluctuating economic growth.

3.4 Summary

My primary set of results is consistent with my hypotheses. The results suggest that it is important to identify not only the potential distortions in stock returns, but also the potential distortions in accounting rates of return. By understanding these distortions, practitioners and researchers can better choose an appropriate risk measure. I provide evidence that accounting policy can distort accounting risk measures. Specifically, I document evidence that (1) accounting betas yield better risk estimates for firms using less conservative accounting and (2) that returns betas provide a superior measure of risk over accounting betas for firms that use more conservative accounting policies during periods of highly fluctuating economic growth. In the next two chapters, I examine the sensitivity of my results to alternative variable and test specifications. I also attempt to independently examine the valuation errors for accounting beta and stock returns beta to investigate the potential for distortion in both risk measures.

CHAPTER 4

SENSITIVITY ANALYSIS

The main analysis largely supports the prediction that accounting conservatism and the absolute value of past investment growth negatively bias accounting betas. In this chapter, I examine the sensitivity of my results to alternative test specifications. I also examine whether the results are largely driven by a small number of industries. I first examine alternative beta specifications that use alternative definitions for the market portfolio or alternative measurement horizons for stock returns beta to better approximate the measurement horizon for accounting beta. I next briefly re-examine whether the primary tests hold after using only pretax income in the definition for ROE. I conclude the chapter with an industry analysis of the results.

4.1 Alternative Beta Specifications

In the primary analysis, I estimate beta as the slope coefficient from a regression of excess firm returns on a market portfolio of excess returns where I define the market portfolio as the value-weighted returns from the S&P 500. A value-weighted S&P 500 portfolio, however, might not be the representative market for accounting ROE. The Standard and Poors website suggests that the 500 companies included in the S&P 500 index are chosen because they are "leading companies in leading industries of the U.S. economy, capturing 75% of coverage of U.S. equities." The choice of companies to include in the index might be subjective and might not be the representative market for accounting ROE. I examine this possibility using two alternative portfolios; an equally-weighted S&P 500 portfolio and a value-weighted portfolio calculated from a sample of firms obtained from the intersection of CRSP and Compustat firms.

I construct market portfolios for both stock returns and accounting ROE. After forming the market portfolios, I re-estimate stock returns beta and accounting beta and re-examine the tests for Hypothesis 2 using the new beta estimates. Although I present only the results for 5-year price-level alphas, the results are similar for each price-level alpha measurement horizon.

Table 4.1 presents the results of the valuation error portfolio tests that estimate accounting beta and stock returns beta using equally-weighted market portfolios comprised of the S&P 500 constituents. The results in Table 4.1 are consistent with the main set of results. The price-level alpha differences are positively associated with accounting conservatism and the absolute value of past investment growth. The diagonal set of portfolios are increasingly positive. Further, the difference between the portfolio of firms having the most conservative accounting and the greatest absolute value of past investment growth and the portfolio of firms having the least conservative accounting and the smallest absolute past investment growth is positive and significant. The difference is close to 2% of the average expected return, and suggests that conservative accounting policy, when combined with the absolute value of past investment growth, is associated with the magnitude of the valuation errors.

I next examine the price-level alpha differences between accounting beta and stock returns beta when each is estimated using a full sample value-weighted market portfolio of either ROE or stock returns. For the full sample market portfolio, I use the intersection of firms from the Compustat and CRSP databases. I use the CRSP-Compustat intersection rather than the full sample of either CRSP data or Compustat data to ensure the comparability between the stock returns market portfolio and the ROE market portfolio.

Standard and Poor's selects S&P 500 Index components to create a portfolio of investments that is representative of the U.S. equity market. The components of the index are selected by a committee. Because the selection is subjective and dependent on how the committee members gauge economic performance, the index might better coincide with stock market performance than with performance as measured by firms' financial statements. As a market portfolio, the S&P 500 Index might distort accounting betas if it is not representative of the market portfolio of ROE. Expanding the market portfolio to encapsulate a broader, less subjective sample of firms might provide a better estimate of the covariance between firm returns and the market portfolio returns, particularly for ROE.

In a final sample that includes all my test variables in addition to an accounting beta calculated using a market portfolio estimated from a full sample of return on equity, the mean accounting beta is 0.395 with a standard deviation of 2.661. Stock returns beta calculated from the same sample has a mean of 1.081 and a standard deviation of 0.655. While expanding the market portfolio sample did not much affect stock returns beta estimates, it had a substantial effect on accounting betas. Based on accounting beta, the

Table 4.1: Equally-Weighted Price-Level Alpha Tests (5-Year)

	$\upsilon_{it}^{roe} - \upsilon_{it}^{ret}$					
	$PInvest_{it}$					
$Conservatism_{it}$	1	2	3	4	5	$(5-1)$
1	-0.0049	-0.0049	-0.0033	-0.0042	0.0006	0.0055
	(-7.30)	(-6.58)	(-4.97)	(-4.87)	(0.65)	(4.97)
2	-0.0049	-0.0033	-0.0029	-0.0018	-0.0016	0.0049
	(-6.79)	(-4.80)	(-4.15)	(-2.73)	(-1.70)	(2.82)
3	-0.0019	-0.0022	-0.0017	-0.0013	0.0007	0.0027
	(-2.39)	(-2.75)	(-2.10)	(-1.65)	(0.80)	(2.17)
4	-0.0015	0.0006	0.0008	0.0023	0.0036	0.0051
	(-1.56)	(0.66)	(1.02)	(2.41)	(3.14)	(3.40)
5	0.0057	0.0089	0.0049	0.0064	0.0110	0.0053
	(4.83)	(8.39)	(4.57)	(4.44)	(7.73)	(2.86)
$(5-1)$	0.0106	0.0137	0.0082	0.0106	0.0104	0.0159
	(7.82)	(10.65)	(6.50)	(6.30)	(6.25)	(10.11)

Notes: This table presents the mean differences between price-level alphas for accounting beta and stock returns beta across conservatism ($Conservatism_{it}$) and absolute past investment growth ($|PInvest_{it}|$)quintiles. Price-level alphas are the residuals from regressions of discounted average market returns on either accounting beta or stock returns beta. I discount average future market returns over a 5-year holding period using a constant discount rate equal to 2.5%. I use the S&P 500 index as a market portfolio proxy. Accounting beta is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on the estimated excess market portfolio ROE. Stock returns beta is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. In this table, I use equally-weighted market portfolios to estimate the betas. $Conservatism_{it}$ equals R&D and advertising expenses divided by total investments. $|PInvest_{it}|$ is the geometric average of past total investment growth over the estimated average useful life of a firm's assets, where average useful life equals current gross property, plant, and equipment divided by current depreciation expense. T-statistics are reported in parentheses. The t-statistics for the portfolio differences presented in the last row and last column assume unequal variances. The two numbers in the last row and last column evaluate the differences between the highest $Conservatism_{it}$ and $|PInvest_{it}|$ portfolio and the lowest $Conservatism_{it}$ and $|PInvest_{it}|$ portfolio.

final sample appears predominantly comprised of firms that are, on average, less risky than the market portfolio. However, the sample retains a wide degree of risk variation based on accounting beta.

Table 4.2 shows the results of the price-level alpha, or valuation error, comparisons between accounting beta and stock returns beta. The results remain consistent with the main set of results. Price-level alpha differences are positively associated with accounting conservatism and the absolute value of past investment growth and the diagonal set of portfolios are increasingly positive. Further, the difference between the extreme portfolios having the most and least conservative accounting and the greatest and smallest absolute past investment growth remains positive and significant.

Rather than the market portfolio introducing systematic beta valuation error differences, the measurement horizon might also introduce systematic distortions. In the main tests, stock returns beta is measured using monthly data over the prior 5 years. Accounting beta, in contrast, is measured using annual data over the prior 10 years. To examine whether these differences bias my results, I estimate a stock returns beta using annual returns data over the prior 10 years.

I lengthen the measurement horizon for stock returns beta rather than shorten the measurement horizon for accounting beta for two reasons. First, Cohen et al. (2009) suggest that one reason accounting betas might provide superior risk estimates over stock returns beta is because they avoid introducing short-term market inefficiencies to the returns estimates. By lengthening the stock returns measurement horizon, I might alleviate some of this problem. Second, specific accounting data items are not widely available in firms' quarterly reports.

Table 4.3 presents the price-level alpha comparisons when using 10-year annual stock returns to estimate stock returns beta. The results are again similar to the main set of results.

4.2 Industry Analysis

The descriptive statistics for accounting beta suggest that I might be examining a sample of firms that truly are less risky than the average firm. Alternatively, the sample might consist of firms that are predominantly more conservative than the average sample firm. Both situations might lead to incorrect conclusions to the extent they suggest that the results are being driven entirely by a subset of firms. I have some assurance that my sample contains sufficient variation in a firm's level of conservatism because I am able to observe significant differences among quintile sorts for accounting beta and stock returns

Table 4.2: Price-Level Alpha Comparisons - Full Sample Market Portfolios (5-Year)

	$\upsilon_{it}^{roe} - \upsilon_{it}^{ret}$					
	$PInvest_{it}$					
$Conservatism_{it}$	1	2	3	4	5	$(5-1)$
1	-0.0053	-0.0042	-0.0013	0.0006	0.0041	0.0094
	(-12.57)	(-10.44)	(-3.29)	(1.58)	(9.01)	(15.17)
2	-0.0050	-0.0035	-0.0015	-0.0005	0.0028	0.0078
	(-11.47)	(-8.96)	(-3.97)	(-1.29)	(6.23)	(12.45)
3	-0.0047	-0.0026	-0.0015	0.0001	0.0007	0.0089
	(-10.55)	(-5.73)	(-3.68)	(0.28)	(0.80)	(13.57)
4	-0.0042	-0.0016	-0.0009	0.0017	0.0059	0.0101
	(-7.72)	(-3.08)	(-1.87)	(3.51)	(11.29)	(13.41)
5	0.0013	0.0014	0.0025	0.0057	0.0071	0.0059
	(1.67)	(1.89)	(3.56)	(7.54)	(10.09)	(15.12)
$(5-1)$	0.0066	0.0056	0.0038	0.0051	0.0031	0.0125
	(7.48)	(6.68)	(4.71)	(5.89)	(3.64)	(15.12)

Notes: This table presents the mean differences between price-level alphas for accounting beta and stock returns beta across conservatism ($Conservatism_{it}$) and absolute past investment growth ($|PInvest_{it}|$)quintiles. Price-level alphas are the residuals from regressions of discounted future S&P 500 market returns on either accounting beta or stock returns beta. I discount S&P 500 market returns over a 5-year holding period using a constant discount rate equal to 2.5%. Accounting beta is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on the estimated excess market portfolio ROE. Stock returns beta is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. In this table, I use a market portfolio constructed from a full sample intersection of firms in the CRSP and Compustat databases. $Conservatism_{it}$ equals R&D and advertising expenses divided by total investments. $|PInvest_{it}|$ is the geometric average of past total investment growth over the estimated average useful life of a firm's assets, where average useful life equals current gross property, plant, and equipment divided by current depreciation expense. T-statistics are reported in parentheses. The t-statistics for the portfolio differences presented in the last row and last column assume unequal variances. The two numbers in the last row and last column evaluate the differences between the highest $Conservatism_{it}$ and $|PInvest_{it}|$ portfolio and the lowest $Conservatism_{it}$ and $|PInvest_{it}|$ portfolio.

Table 4.3: Five-Year Price-Level Alpha Comparisons using an Annual Stock Returns Beta

$\upsilon_{it}^{roe} - \upsilon_{it}^{ret}$

	$\lvert PInvest_{it}\rvert$					
$Conservatism_{it}$	1	2	3	4	5	$(5-1)$
1	-0.0144	-0.0091	-0.0023	0.0029	0.0081	0.0102
	(-9.06)	(-5.97)	(-1.44)	(1.59)	(3.79)	(10.25)
2	-0.0099	-0.0091	-0.0069	-0.0043	0.0036	0.0107
	(-6.49)	(-5.92)	(-4.20)	(-2.53)	(1.15)	(11.36)
3	-0.0095	-0.0026	-0.0075	-0.0012	0.0126	0.0035
	(-3.95)	(-0.87)	(-5.04)	(-0.74)	(5.12)	(7.25)
4	-0.0035	-0.0051	0.0000	0.0047	0.0139	0.0093
	(-1.40)	(-2.59)	(-0.02)	(2.53)	(5.25)	(8.70)
5	0.0040	0.0051	0.0044	0.0144	0.0146	0.0077
	(1.40)	(1.98)	(1.75)	(4.58)	(4.63)	(6.95)
$(5-1)$	0.0183	0.0141	0.0066	0.0115	0.0066	0.0290
	(5.66)	(4.75)	(2.25)	(3.16)	(1.73)	(8.21)

Notes: This table presents the mean differences between price-level alphas for accounting beta and stock returns beta across conservatism ($Conservatism_{it}$) and absolute past investment growth ($\lvert PInvest_{it}\rvert$)quintiles. Price-level alphas are the residuals from regressions of discounted average market returns on either accounting beta or stock returns beta. I discount average future market returns over a 5-year holding period using a constant discount rate equal to 2.5%. I use the S&P 500 index as a market portfolio proxy. Accounting beta is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on the estimated excess market portfolio ROE. Stock returns beta is the slope coefficient from a 10-year yearly regression of a firm's excess stock return on the excess market portfolio stock return. $Conservatism_{it}$ equals R&D and advertising expenses divided by total investments. $\lvert PInvest_{it}\rvert$ is the geometric average of past total investment growth over the estimated average useful life of a firm's assets, where average useful life equals current gross property, plant, and equipment divided by current depreciation expense. T-statistics are reported in parentheses. The t-statistics for the portfolio differences presented in the last row and last column assume unequal variances. The two numbers in the last row and last column evaluate the differences between the highest $Conservatism_{it}$ and $\lvert PInvest_{it}\rvert$ portfolio and the lowest $Conservatism_{it}$ and $\lvert PInvest_{it}\rvert$ portfolio.

beta valuation error differences. However, to provide additional reassurance that the dataset is not limited to two or three unique sets of firms, I next conduct an industry analysis of my portfolio tests.

I restrict the industry analysis to the diagonal set of portfolios in my tests since the diagonal portfolios summarize well the overall results. In the analysis, I identify industries using the first-digit of the firm's SIC code obtained from Compustat. I omit SIC codes 6000-6999 because they are not included in my final sample. When SIC codes are missing from a firm-year observation in Compustat, I backfill future SIC code data for the firm to determine its SIC. When no data is available, I classify the firm's industry as Unknown. Table 4.4 presents the results of my analysis.

In Panel A of Table 4.4, I examine the relative proportion of each industry within each diagonal quintile portfolio sorted by accounting conservatism and the absolute value of past investment growth. Although the sample is dominated by industries having a first-digit SIC of 2 or 3, I find that industry representation within each portfolio is not restricted to a single industry in any of the portfolios. First-digit SIC industry 2 can be broadly characterized as the consumer goods industry, including food and textiles. First-digit SIC industry 3 can be broadly characterized as construction and machinery, including automobiles and airplanes. For the majority of portfolios, industry representation appears consistent across each portfolio. The exceptions are first-digit SIC industries 1, 4, and 7. Industries 1 and 4 tend to cluster in the first portfolio pair, and industy 7 tends to cluster in the fifth portfolio pair.

The first portfolio pair consists of firms having the least conservative accounting and smallest absolute value of past investment growth. Industries classified with a first-digit SIC equal to 1 are characterized by the oil and mining industries. These industries tend to capitalize their assets and their depletion schedules are governed by some of the most sophisticated accounting. The classification of these firms predominantly within the first and second quintile pairs seems appropriate given that I would expect their accounting to be among the least conservative.

Industries classified with a first-digit SIC equal to 4 are characterized by the transportation and utilities industries. Both are highly regulated and likely have asset values that closely correspond to their true values. Transportation industries tend to have large quantities of depreciable assets and their depreciation schedules might highly correspond with the revenues generated. The low conservatism quintile ranking for these industries seems consistent.

Table 4.4: Industry Analysis within Quintile Portfolio Rankings for Conservatism and Absolute Past Investment Growth

Panel A: Industry proportion across 5x5 double-sorted portfolios

	First-Digit SIC									
Quintile Pair	Unknown	0	1	2	3	4	5	7	8	9
(1, 1)	0.08	0.01	0.05	0.33	0.30	0.08	0.09	0.05	0.02	0.00
(2, 2)	0.08	0.00	0.02	0.27	0.45	0.02	0.12	0.02	0.02	0.00
(3, 3)	0.10	0.00	0.00	0.23	0.50	0.01	0.09	0.05	0.02	0.00
(4, 4)	0.08	0.00	0.01	0.20	0.56	0.01	0.06	0.06	0.01	0.00
(5, 5)	0.04	0.00	0.01	0.30	0.39	0.01	0.05	0.19	0.01	0.00
Full Sample	0.08	0.00	0.01	0.22	0.47	0.02	0.09	0.07	0.02	0.00

Panel B: Average conservatism across 5x5 double-sorted portfolios

	First-Digit SIC									
Quintile Pair	Unknown	0	1	2	3	4	5	7	8	9
(1, 1)	0.11	0.13	0.07	0.11	0.12	0.11	0.12	0.10	0.14	0.04
(2, 2)	0.30	0.33	0.27	0.31	0.31	0.31	0.30	0.32	0.32	0.32
(3, 3)	0.48	0.55	0.52	0.48	0.48	0.46	0.48	0.47	0.49	0.42
(4, 4)	0.65	0.63	0.68	0.66	0.66	0.66	0.65	0.69	0.69	–
(5, 5)	0.86	0.87	0.87	0.91	0.87	0.90	0.88	0.88	0.85	1.00
Full Sample	0.38	0.41	0.26	0.48	0.54	0.20	0.40	0.60	0.43	0.28

Table 4.4 – Continued…

Panel C: Average absolute value of past investment growth across 5x5 double-sorted portfolios

	First-Digit SIC									
Quintile Pair	Unknown	0	1	2	3	4	5	7	8	9
(1, 1)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
(2, 2)	0.06	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
(3, 3)	0.10	0.09	0.10	0.10	0.10	0.08	0.10	0.10	0.10	0.09
(4, 4)	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.17	–
(5, 5)	0.29	0.56	0.32	0.40	0.34	0.35	0.34	0.44	0.47	0.25
Full Sample	0.16	0.15	0.13	0.12	0.12	0.14	0.14	0.18	0.18	0.11

Notes: This table presents industry descriptive statistics for the 5x5 double-sorted portfolios based on conservatism and the absolute value of past investment growth. Only the diagonal portfolios are presented. To categorize firms into industries, I use the first-digit of the firm's Standard Industrial Classification (SIC) as reported in Compustat. If the SIC is missing for a given firm-year, I back-fill the SIC when future firm SIC data are available. When the data are not available, I classify the firm's industry as "Unknown." Panel A presents the proportion of an industry represented in a portfolio. Panel B present the average conservatism and Panel C the average absolute value of past investment growth across portfolios for an industry. I measure conservatism as R&D and advertising expenses divided by total investments. $|PInvest_{it}|$ equals the geometric average of past total investment growth over the estimated average useful life of a firm's assets, where average useful life equals current gross property, plant, and equipment divided by current depreciation expense.

Industries classified with a first-digit SIC equal to 7 can be broadly characterized as service industries. For service industries, the proportion of capitalized expenditures to those that are immediately expensed is likely small. The relatively large proportion of service industry firms in the fifth quintile pairs is therefore not unexpected.

Firms are classified into a portfolio not only by their conservatism ranking, but also their growth rankings. To help distinguish between these two contributing factors, I examine the average conservatism within each portfolio across different industries in Panels B and C. Consistent with first-digit SIC industries 1 and 4 consisting predominantly of less conservative firms, Panel B shows that these two industries have the lowest average conservatism for the sample. Similarly, firms having a first-digit SIC of 7 appear to have a higher mean conservatism.

Overall, the results suggest that the valuation error portfolio tests are not dominated by one particular industry in any of the portfolios. They are, however, consistent with increasing (but not dominating) proportions of certain industries within the extreme portfolios.

4.3 Pretax Analysis

In the main analysis, I adjust pretax income for the marginal tax rate to calculate ROE. The adjustment is consistent with previous research by Penman and Zhang (2002), but it might affect only accounting beta, especially if the market considers only pretax income. However, because I make the adjustment to both firm-level ROE and market portfolio ROE, the covariances should eliminate the effect of the adjustment on accounting beta. I investigate this by re-examining a test that calculates ROE, and accounting beta, using pretax income. Table 4.5 presents the results of the accounting beta regressions on accounting conservatism and the absolute value of past investment growth.

The coefficient on the interaction between accounting conservatism and the absolute value of past investment growth remains negative and significant. For the regression model that controls for risk, the interaction coefficient suggests that, for a firm having an average absolute past investment growth equal to approximately 14%, a 1% increase in the proportion of current period conservatively reported investments (i.e. investments immediately expensed) relative to total investments reduces the amount of variance that firm i contributes to market variance by approximately 0.01, ceteris paribus. Similarly, for a firm having an average proportion of conservatve investment equal to approximate 48%, a 1% increase in the firm's average absolute past investment growth rate reduces the amount of variance that firm i contributes to market market variance by approximately 0.003. In untabulated results, I also find that the valuation error differences between accounting beta

Table 4.5: Accounting Beta Analysis Using Pretax Income

$\beta_{it}^{roe} = \gamma_0 + \gamma_1 Conservatism_{it} + \gamma_2 \lvert PInvest_{it} \rvert + \gamma_3 Conservatism_{it} * \lvert PInvest_{it} \rvert + \gamma_4 \beta_{it}^{ret} + \varepsilon_{it}$		
Intercept	0.831**	0.597**
	(12.668)	(8.500)
$Conservatism_{it}$	-0.766**	-0.903**
	(-6.845)	(-8.017)
$\lvert PInvest_{it} \rvert$	1.014**	0.696*
	(2.960)	(2.025)
$Conservatism_{i,t} * PInvest_{i,t}$	-2.242**	-2.003**
	(-4.113)	(-3.675)
β_{it}^{ret}	-	0.307**
	-	(9.230)
$Adj.R^2$	0.006	0.008

Notes: This table presents the results of panel data regressions of accounting beta (β_{it}^{roe}) on conservatism ($Conservatism_{it}$), absolute past investment growth ($|PInvest_{it}|$), and stock returns beta (β_{it}^{ret}) over a sample of 31,997 firm-year observations from 1980 to 2009 (t-values in parentheses). I estimate accounting beta as the slope coefficient from yearly regressions of a firm's excess return-on-equity (ROE) on the excess ROE of a market portfolio composed of the S&P 500 constituent firms. I calculate ROE as pretax income divided by lagged book equity. I estimate stock returns beta as the slope coefficient from a monthly regression of a firm's excess returns on the excess market return from the market portfolio of S&P 500 firms. I estimate conservatism as the sum of R&D and advertising expenses divided by total investments, where total investments is the sum of R&D, advertising, and capital expenditures. I measure past investment change as the absolute value of the geometric average of past investment growth calculated over the average useful life of a firm's assets. Useful life equals a firm's gross property, plant, and equipment divided by the firm's current-year depreciation expenses. * and ** indicate significance with $p < .05$ and $p < 0.01$, respectively.

and stock returns beta are increasingly positive across quintile portfolios for accounting conservatism and the absolute value of past investment growth, consistent with the main test results.

4.4 Summary

I examine the sensitivity of my results to alternative test specifications, including alternative definitions of the market portfolio and alternative measurement horizons for stock returns beta that more closely match the measurement horizon for accounting beta. I also examine the industry composition of my conservative accounting and absolute investment growth portfolios. Each of these analyses yields results that are similar to the results in my primary analysis, suggesting that the results are robust to alternative beta measurement specifications and to industry composition.

This chapter examined whether my results are sensitive to how betas are measured or how accounting conservatism and investment growth are associated with specific industries. In Chapter 5, I examine an alternative approach to estimating valuation errors.

CHAPTER 5

ACCOUNTING BETA VALUATION ERROR TESTS

In my primary analysis, I follow prior literature to assess the ability of stock returns beta and accounting beta to capture the economic risks that underlie firms' value-generating processes by comparing the measures' valuation errors. I estimate the risk measures' valuation errors by separately regressing future realized market portfolio returns on each risk measure. This approach is similar to other studies that assess cost of equity measures via their association with firm-specific future realized stock returns (e.g., Easton & Monahan, 2005). A limitation to using firm-specific realized returns to proxy for expected returns is that realized returns also incorporate investors' revisions to their future cash flow expectations. Vuolteenaho (2002) suggests that investors' cash flow revisions are a significant component of firm-specific realized returns. Therefore, if cash flow news is left uncontrolled for while estimating valuation errors from future realized returns, the valuation errors might include a significant component related to cash flows news. Rather than firm-specific realized returns, I follow Cohen et al. (2009) to estimate valuation errors using market portfolio returns. Market portfolio returns might mitigate problems associated with investors' firm-specific cash flow revisions, but they might still contain a component of aggregate cash flow news. They also potentially sacrifice firm-specific information that is crucial to assessing the accounting beta distortion that is associated with conservative accounting and the absolute value of past investment growth.

In my primary tests, I attempt to control for residual cash flow news in aggregate market portfolio returns by examining the differences between the valuation errors for accounting beta and the valuation errors for stock returns beta. To the extent accounting betas and stock returns betas are uncorrelated with cash flow news, the differences between the valuation errors should indirectly control for cash flow news by differencing out the common cash flow news component among the two sets of errors.[1] Differencing the valuation errors between the two models, however, assumes a benchmark model as a comparison. In addition, using aggregate market portfolio information also fails to capture firm-specific valuation error information that might be critical to the analysis. A preferable approach would be to directly analyze the association between accounting beta valuation errors (or stock returns beta valuation errors) and both accounting conservatism and the absolute value of past investment growth using firm-specific rate of return information. However, without adequate controls for cash flow news or discount rate news that are left unexplained by the CAPM, an interpretation of the results of a direct test might prove difficult.

In this chapter, I explore direct tests of the accounting beta distortion and also an alternative firm-specific valuation error estimate. For the direct tests of the accounting beta distortion that is associated with accounting conservatism, I examine the following hypothesis:

H3: *Accounting beta valuation errors are positively associated with accounting conservatism and the absolute value of past investment growth.*

I also examine a similar hypothesis for stock returns beta. Penman and Zhang (2002) document evidence that investors fail to immediately fully adjust for the ROE distortion associated with accounting conservatism and past investment growth so that the distortion is partially incorporated into current equity prices and subsequent equity returns. My predictions regarding the relative risk precision of accounting beta and stock returns beta rely on the assumption that the market makes at least partial significant corrections to the bias in ROE so that the valuation errors associated with conservative accounting and past investment growth will be, on average, smaller for stock returns beta than for accounting beta. By independently examining the valuation errors for accounting beta and stock returns beta, my objective is to provide evidence of the significance of the accounting distortion to accounting beta and potentially to stock returns beta.

[1] In untabulated analysis, I examine valuation error tests that attempt to control for potential cash flow news in realized market portfolio returns. As cash flow news controls, I use the difference between firm-specific realized 1-year ahead earnings per share and forecasted earnings per share, and the difference between 1-year ahead and current forecasts of long-term growth. I find evidence that the cash flow news proxies do not adequately control for the information present in future realized returns. However, differencing the valuation errors between accounting beta and stock returns beta again appears to adequately control for the additional information. Further analysis in this chapter further supports the merits of differencing to control for cash flow and risk factors not fully explained by either stock returns or accounting beta.

5.1 Measuring Valuation Errors using a Firm-Specific Implied Cost of Equity Capital Measure

I use an implied cost of equity capital measure as a firm-specific alternative to using value-weighted market returns to estimate the valuation errors for stock returns beta and accounting beta. Implied cost of equity capital measures are rate of return estimates motivated by specific valuation models along with corresponding assumptions. For example, several implied cost of equity capital measures derive from finite-period dividend discount models. Implied cost of equity capital measures invert the valuation model, the dividend discount model for example, to express the discount rate as a function of the sum of future dividends divided by price. Implied cost of equity models vary by valuation approach and by the terminal value and discount rate assumptions applied to simplify the inverted discount rate expression.

A notable feature of implied cost of equity rate of return estimates relative to realized return-based rate or return estimates is that implied cost of equity capital estimates frequently avoid using future realized returns inputs that also contain investors' forecast revisions. Implied cost of equity capital estimates generally limit the estimation inputs to contemporaneous forecast and equity price information. Therefore, they might be less directly correlated with the cash flow news portion of future realized returns that arise from investors' forecast revisions.

I use an implied cost of equity capital measure to estimate valuation errors by using the measure as a proxy for the risk that is implicit in equity prices. Therefore, I regress the implied cost of equity capital measure on each beta risk estimate and again use the residuals as the valuation error estimates for each risk measure. I estimate implied cost of equity capital using the price-earnings ratio relative to growth model (r_{peg}). The recent literature that compares the validity of alternative implied cost of equity capital measures generally concludes that r_{peg} demonstrates superior empirical validity relative to many of the other measures (Botosan & Plumlee, 2005; Botosan, Plumlee, & Wen, 2011).[2] I estimate r_{peg} as

$$r_{peg} = \sqrt{(feps_3 - feps_2)/prc}, \tag{5.1}$$

where $feps_2$ and $feps_3$ are the 2-year and 3-year ahead analyst consensus earnings-per-share forecasts, and prc is the equity price for the firm. All of the variables are measured as of the

[2]If r_{peg} or other implied cost of equity capital measures based on accounting valuation models provide superior risk estimates, one might question why I examine accounting beta. Because the objective in implied cost of equity capital measures is to estimate the risk implicit in equity prices, the use of such measures for valuation that attempts to derive price is questionable.

risk assessment date, which is 4 months after the firm's last fiscal-year end. I obtain 2-year ahead analyst consensus earnings-per-share forecast data directly from I/B/E/S, whereas I approximate analyst consensus 3-year ahead earnings-per-share forecasts using I/B/E/S 2-year ahead analyst consensus forecasts along with the analyst consensus long-term growth forecast ($Ltg\_Forecast$). Specifically, I approximate the 3-year ahead earnings-per-share forecast as the product of the 2-year ahead analyst consensus earnings-per-share forecast and one plus the analyst consensus long-term growth forecast.

Using r_{peg}, I estimate the valuation errors for accounting beta and stock returns beta as the residuals from regressions of the form

$$(r_{peg,it} - rf_t) = \gamma_0 + \gamma_1 \beta_{it} + \gamma_2 ln\,(mve_{it}) + \gamma_3 mb_{it} + \upsilon_{it}, \tag{5.2}$$

where rf_t is an estimate of the contemporaneous risk-free rate, $ln\,(mve_{it})$ is the natural log of the firm i's period t market value of equity, and mb_{it} is firm i's period t market-to-book equity. Subtracting the risk-free rate from the implied cost of equity capital in Equation (5.2) permits the dependent variable to estimate only the expected risk premium implicit in current period prices. To proxy the risk-free rate, I use the de-annualized monthly reported yield from a 10-year treasury bond. I include the natural log of market value of equity and also market-to-book equity to control for additional components of risk potentially left unexplained by either accounting beta or stock returns beta.

Berk (1995) suggests that firm size, or the log of the market value of equity, implicitly captures the discount rate applied to expected cash flows. If two firms have identical expected cash flows, the firm having the cash flows that the market considers riskier will have a lower market value of equity due to the discount included in market price. Further, Berk (1995) provides evidence that if an asset-pricing model leaves some part of risk unexplained, or if the impirical test of the theoretical model is misspecified, then market value of equity should correlate with the part of the risk that is left unexplained by the model.

Prior literature also suggests that expected future growth might be an additional risk factor to CAPM beta (e.g., Botosan et al., 2011; Fama & French, 1995). Fama and French (1995) suggest that market-to-book equity implicitly captures investors' growth expectations that might represent a separate risk premium that is not fully captured by stock returns beta. To avoid confusing the growth risk premium with the conservatism and growth distortion in accounting beta, I control for investors' growth expectations while estimating the valuation errors.

Table 5.1 presents descriptive statistics for $r_{peg,it}$ and the other risk measures. $r_{peg,it}$ estimates the mean expected rate of return implied by equity prices at approximately 10%.

Table 5.1: Descriptive Statistics for Alternative Risk Measures and Controls

			Percentiles		
Variable	Mean	Std. Dev.	25	50	75
$r_{peg,it}$	0.101	0.033	0.081	0.096	0.115
rf_t	0.066	0.027	0.044	0.058	0.082
mb_{it}	2.849	2.902	1.394	2.098	3.285
$ln\,(mve_{it})$	6.898	1.939	5.461	6.769	8.146

Notes: The table presents descriptive statistics for the price-to-earnings growth implied cost of equity capital measure, $r_{peg,it}$, along with the risk-free rate (rf_t), firms' market-to-book equity (mb_{it}), and the natural log of firms' market value of equity ($ln\,(mve_{it})$). r_{peg} equals the square root of the difference between 3-year-ahead and 2-year-ahead analyst consensus earnings-per-share forecasts, scaled by current market price. rf_t equals the de-annualized monthly reported yield from a 10-year treasury bond. $ln\,(mve)$ is the natural log of the market value of equity obtain by multiplying shares ourstanding by current equity price. mb_{it} equals market value of equity divided by book value of equity. The descriptives are for a sample of 17,994 firm-year observations spanning 1981 through 2010.

The average monthly reported yield on a 10-year treasury bond is near 7%. The mean market-to-book ratio suggests that expected growth for the average firm is close to three times book value. Similar to prior research, the mean natural log of market value of equity is approximately 6.9.

After merging my sample with the I/B/E/S data, the number of firm-year observations having a complete set of data is reduced to 17,994. To assess whether the reduced number of observations provides findings that differ from my main set of results, I re-examine an OLS regression of accounting beta on accounting conservatism and the absolute value of past investment growth. I present these results in Table 5.2.

Consistent with Hypothesis 1, the association between accounting beta and the interaction between accounting conservatism and the absolute value of past investment growth remains negative and significant even after controlling for risk using stock returns beta. However, the coefficient on the interaction term appears diminished for the smaller sample. For the regression model that controls for risk, the interaction coefficient suggests that, ceteris paribus, a 1% increase in the proportion of current period conservatively reported investments (i.e., investments immediately expensed) relative to total investments reduces the amount of variance that firm i contributes to market variance by approximately 0.003 plus 0.009 multiplied by the firm's average absolute past investment growth rate. For a firm

Table 5.2: Accounting Beta Analysis (r_{peg} Sample)

$\beta_{it}^{roe} = \gamma_0 + \gamma_1 Conservatism_{it} + \gamma_2 \lvert PInvest_{it} \rvert + \gamma_3 Conservatism_{it} * \lvert PInvest_{it} \rvert + \gamma_4 \beta_{it}^{ret} + \varepsilon_{it}$		
Intercept	0.546**	0.336**
	(11.180)	(6.274)
$Conservatism_{it}$	-0.207*	-0.342**
	(-2.279)	(-3.721)
$\lvert PInvest_{it} \rvert$	0.836**	0.588*
	(3.346)	(2.347)
$Conservatism_{it} * \lvert PInvest_{it} \rvert$	-1.032*	-0.890*
	(-2.337)	(-2.019)
β_{it}^{ret}	-	0.265**
	-	(9.392)
$Adj.R^2$	0.002	0.007

Notes: This table presents the results of OLS panel data regressions of accounting beta (β_{it}^{roe}) on accounting conservatism ($Conservatism_{it}$), the absolute value of past investment growth ($|PInvest_{it}|$), and stock returns beta (β_{it}^{ret}). β_{it}^{roe} is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on estimated excess market portfolio ROE. β_{it}^{ret} is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. I use the S&P 500 index to proxy for the market portfolio. $Conservatism_{it}$ equals the sum of R&D and advertising expenses divided by total investments. $|PInvest_{it}|$ is the geometric average of past total investment growth over the estimated average useful life of a firm's assets. * and ** indicate significance at $p < 0.05$ and $p < 0.01$,respectively.

having an average absolute past investment growth rate equal to approximately 14%, a 1% increase in the proportion of conservative investments decreases the variance contributed to the market ROE variance by 0.005. Similarly, a 1% increase in the firm's average absolute past investment growth rate contributes to market portfolio ROE variance by approximately 0.006 less 0.009 multiplied by the firm's proportion of conservative investment. For a firm having an average proportion of conservative investment equal to approximately 48%, a 1% increase in the firm's average absolute past investment growth rate adds approximately 0.002 to the market portfolio ROE variance. If a firm with average conservatism similarly has average absolute past investment growth, the net effect on the firm's contribution to market portfolio ROE variance is approximately -0.003, ceteris paribus. The net effect is negative and is related to the hypothesized negative distortion associated with a firm's conservative accounting.

I next examine the firm-specific valuation errors associated with the accounting conservatism and absolute past investment growth distortion. Table 5.3 presents the results of estimating the valuation errors for both accounting beta and stock returns beta, with and without controlling for firm growth and firm size. As expected, the coefficient on stock returns beta is positive and significant. However, the coefficient on accounting beta is negative and significant. Both the accounting beta and stock returns beta coefficients remain largely unchanged after including controls for firm growth and firm size. In general, the negative coefficient on accounting beta suggests that a ceteris paribus unit increase in the covariance between firm ROE and marketwide ROE is associated with a 0.1% decline in the firm's implied rate of return. In contrast, a ceteris paribus unit increase in the covariance between firm stock returns and marketwide stock returns is associated with a

Table 5.3: Firm-Specific Valuation Error Estimation

$$(r_{peg,it} - rf_{it}) = \gamma_0 + \gamma_1\beta_{i,t} + \gamma_2 ln\,(mve_{it}) + \gamma_3 mb_{it} + \upsilon_{it}$$

	γ_0	γ_1	γ_2	γ_3	Adj. R^2
β_{it}^{roe}	0.0358**	-0.0013**			0.0063
	(131.65)	(-10.76)			
	0.0451**	0-.0014**	-0.0015**	0.0004**	0.0122
	(45.92)	(-11.34)	(-10.40)	(3.89)	
β_{it}^{ret}	0.0305**	0.0041**			0.0046
	(53.87)	(9.19)			
	0.0391**	0.0039**	-0.0013**	0.0003**	0.0092
	(34.48)	(8.62)	(-9.22)	(3.50)	

Notes: The table presents the coefficient estimates from OLS regressions of a price-to-earnings growth implied cost of equity capital estimate (r_{peg}) in excess of the risk-free rate (rf_t) on each beta risk estimate, while controlling for size ($ln\,(mve_{it})$) and expected future growth (mb_{it}). r_{peg} equals the square root of the difference between 3-year-ahead and 2-year-ahead earnings forecasts, scaled by current price. rf_t equals the de-annualized monthly reported yield from a 10-year treasury bond. $ln\,(mve)$ is the natural log of the market value of equity obtain by multiplying shares outstanding by current equity price. mb_{it} equals market value of equity divided by book value of equity. Accounting beta (β_{it}^{roe}) is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on estimated excess market portfolio ROE. Stock returns beta (β_{it}^{ret}) is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. t-values are in parentheses. ** denotes significance at $p < 0.01$.

0.4% increase in the firm's implied rate of return.

The negative coefficient on accounting beta might indicate that the conservative accounting and absolute past investment growth distortion is biasing the association between accounting beta and r_{peg}. Prior literature documents evidence that r_{peg} is strongly correlated with growth (e.g., Botosan et al., 2011). If r_{peg} is correlated to the growth component of the negative accounting beta distortion, as accounting beta increases, or as the distortion is reduced due to a reduction in past investment growth, the increase might be associated with a smaller r_{peg} due to the reduction in growth. Alternatively, the negative coefficient on accounting beta might indicate that an additional risk factor that is negatively correlated with r_{peg} and positively associated with accounting beta, or vice versa, remains uncontrolled for within the regression model. By examining the valuation errors and some additional tests, I hope to better distinguish between these two possibilities.

In each of the regressions, both of the control variables are significant in the expected direction. They are also of similar magnitudes in each regression. The coefficients on the natural log of the market value of equity suggest that a 1% increase in a firm's market value of equity is associated with a 0.001% decrease in the firm's implied rate of return, which is consistent with investors' perceiving smaller firms as having more risk. The coefficients on the market-to-book ratio suggest that a unit increase in the ratio is associated with a 0.04% increase in the firm's implied rate of return, consistent with the interpretation that investors' perceive greater growth potential and greater risk in firms having market values that exceed their book values.

I next test Hypothesis 3 by independently examining the valuation errors for accounting beta and stock returns beta. Specifically, I examine the association between the valuation errors and both accounting conservatism and past investment growth to directly test whether accounting conservatism biases the valuation performance of accounting betas. Table 5.4 presents the results.

As hypothesized, the association between the beta valuation errors and accounting conservatism and the absolute value of past investment growth is significant and positive. Both the coefficient for the accounting beta and stock returns beta are of similar magnitudes. Likewise, the seperate coefficients for conservatism and the absolute value of past investment growth are significant and positive, and they have similar coefficient magnitudes. The coefficients suggest that for a firm having an average proportion of conservative investments equal to 48%, a 1% increase in the firm's average absolute past investment growth, ceteris paribus, is associated with a downward bias in accounting beta such that accounting beta

Table 5.4: r_{peg} Valuation Error Tests

$$\upsilon_{it} = \delta_0 + \delta_1 Conservatism_{it} + \delta_2 |PInvest_{it}| + \delta_3 Conservatism_{it} * |PInvest_{it}| + \eta_{it}$$

	β_{it}^{roe}	β_{it}^{ret}
Intercept	-0.006**	-0.005**
	(-7.80)	(-6.45)
$Conservatism_{it}$	0.007**	0.006**
	(5.03)	(4.02)
$\|PInvest_{it}\|$	0.015**	0.011**
	(3.65)	(2.62)
$Conservatism_{i,t} * \|PInvest_{i,t}\|$	0.012†	0.015*
	(1.68)	(2.09)
$Adj.R^2$	0.010	0.003

Notes: This table presents the results of panel data regressions of valuation errors for accounting beta (β_{it}^{roe}) or stock returns beta (β_{it}^{ret}) on accounting conservatism ($Conservatism_{it}$) and the absolute value of past investment growth ($PInvest_{it}$). The valuation errors are the residuals (υ_{it}) from regressions of implied cost of equity capital using a PEG ratio (r_{peg}) on each beta risk measure, controlling for size and growth. Accounting beta (β_{it}^{roe}) is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on estimated excess market portfolio ROE. Stock returns beta (β_{it}^{ret}) is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. $Conservatism_{it}$ equals R&D and advertising expenses divided by total investments. $|PInvest_{it}|$ is the geometric average of past total investment growth over the estimated average useful life of a firm's assets. t-values are in parentheses. †, *, and ** denote significance at $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively.

underestimates the implied cost of equity capital by approximately 0.02%. Similarly, for a firm having an average absolute past investment growth rate equal to 14%, a 1% increase in the firm's proportion of conservative investments, ceteris paribus, is associated with a downward biase in accounting beta such that accounting beta underestimates the implied cost of equity capital by approximately 0.01%. For a firm having average conservatism and an average absolute value of past investment growth, the model estimates suggest that accounting beta underestimates the implied cost of equity capital by approximately 0.6%.

The results in Table 5.4 suggest that both accounting beta and stock returns beta valuation errors are associated with the joint effects of conservative accounting and the absolute value of past investment growth. However, I am unable to distinguish the relative magnitude of the bias in each of the beta risk measures. Further, when combining these results with the parameter estimates for accounting beta and stock returns beta in the valuation error regression model appearing in Table 5.3, it is unclear whether there still remains additional risk factors left unexplained by the valuation error regression model. In the valuation error regression model, the coefficient corresponding to accounting beta is negative while the coefficient for stock returns beta is positive. Yet, the assocation between the valuation errors and accounting conservatism and the absolute value of past investment growth appears to be similar in magnitude for both accounting beta and stock returns beta. To control for any risk that remains unexplained in the valuation error model, I again examine the valuation error differences between accounting beta and stock returns beta. Table 5.5 presents the results.

Consistent with the main set of results, the valuation error differences for accounting beta and stock returns beta are increasingly positive for portfolios of firms having more conservative accounting and greater absolute values of past investment growth. The difference between the valuation error differences for the portfolio of firms having the highest proportion of conservative investment and highest absolute value of average past investment growth and the portfolio of firms having the lowest proportion of conservative investment and lowest absolute past investment growth is approximately a rate of return equal to 0.1%. The results suggests that the market might partially correct for the ROE distortion in stock prices and returns. The results also suggest that the firm-specific implied rate of return estimate along with controls for size and growth might be insufficient to eliminate cash flow news or other unexplained risk factors in the valuation error regressions. Alternatively, prior research suggests cross-sectional correlation in the regression residuals of asset pricing tests might distort the models' implications. In the next section, I examine this possibility using a common approach to correct for the potential cross-sectional correlation in the residuals: Fama-MacBeth adjusted coefficients and t-statistics (Fama & MacBeth, 1973).

5.2 Valuation Error Analysis with Fama-MacBeth Adjustment

A common problem with panel data regressions is cross-sectional correlation among the residuals. Cross-sectional correlation leads to biased standard errors and t-statistics that might also lead to incorrect inferences of a regression model's parameters. In CAPM analysis, cross-sectional correlation in the residuals might occur when a panel regression model fails to explain a common rate of return component.

A traditional approach to correcting for potential cross-sectional correlation in asset

Table 5.5: r_{peg} Valuation Error Differences

$\upsilon_{it}^{roe} - \upsilon_{it}^{ret}$

	$\lvert PInvest_{it}\rvert$					
$Conservatism_{it}$	1	2	3	4	5	$(5-1)$
1	-0.0005	-0.0003	-0.0003	0.0001	0.0005	0.0010
	(-4.54)	(-2.28)	(-2.66)	(0.52)	(3.68)	(5.69)
2	-0.0006	-0.0005	-0.0002	-0.0002	0.0001	0.0007
	(-4.98)	(-4.64)	(-1.78)	(-1.88)	(0.55)	(3.43)
3	-0.0006	-0.0003	-0.0002	-0.0001	0.0003	0.0009
	(-5.59)	(-2.43)	(-1.77)	(-0.88)	(1.42)	(4.10)
4	-0.0004	-0.0001	-0.0003	0.0001	0.0007	0.0011
	(-2.99)	(-0.58)	(-2.14)	(-0.98)	(3.86)	(4.88)
5	0.0000	0.0008	0.0004	0.0009	0.0008	0.0008
	(-0.26)	(4.49)	(2.51)	(4.97)	(4.15)	(3.32)
$(5-1)$	0.0004	0.0010	0.0007	0.0008	0.0003	0.0013
	(2.22)	(5.00)	(3.56)	(3.65)	(1.24)	(5.83)

Notes: This table presents the mean differences between valuation errors for accounting beta and stock returns beta across quintiles for accounting conservatism ($Conservatism_{it}$) and the absolute value of past investment growth ($\lvert PInvest_{it}\rvert$). Valuation errors are estimated as the residuals (υ_{it}) from OLS regressions of excess implied cost of equity capital estimated using a PEG ratio (r_{peg}) on either accounting beta or stock return beta, including controls for size and growth. r_{peg} equals the square root of the difference between 3-year ahead and 2-year ahead earnings forecasts, scaled by current price. I calculate r_{peg} in excess of the risk free rate, which I estimate using the de-annualized monthly reported yield from a 10-year treasury bond. Accounting beta is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on the estimated excess market portfolio ROE. Stock returns beta is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. $Conservatism_{it}$ equals R&D and advertising expenses divided by total investments. $\lvert PInvest_{it}\rvert$ is the geometric average of past total investment growth over the estimated average useful life of a firm's assets. t-statistics are reported in parentheses. The t-statistics for the portfolio differences presented in the last row and last column assume unequal variances. The two numbers in the last row and last column evaluate the differences between the highest $Conservatism_{it}$ and $\lvert PInvest_{it}\rvert$ portfolio and the lowest $Conservatism_{it}$ and $\lvert PInvest_{it}\rvert$ portfolio.

pricing tests is to use Fama-MacBeth adjusted t-statistics and parameter estimates (Fama & MacBeth, 1973). Fama-MacBeth t-statistics have the advantage of not only controlling for cross-sectional correlation in the residuals but also of allowing the regression parameters to vary over time. In the next set of tests, I estimate the valuation error regressions using Fama-MacBeth regressions estimated annually by calendar year. For the valuation error proxies, I collect the residuals from the annual regressions, allowing the residuals to reflect time period differences in firms' level of accounting conservatism and absolute value of past investment growth. If accounting betas and stock returns betas vary significantly over time, comparing the residuals from annual estimates might provide a more appropriate comparison of the valuation errors for each risk estimate. Further, Fama-MacBeth adjusted t-statistics might improve the empirical validity of the t-statistics used in the analysis.

Table 5.6 provides the results of re-estimating the valuation errors using Fama-MacBeth regressions and r_{peg} as the implied rate of return estimate. The average annual coefficient on stock returns beta is positive and significant, but the coefficient on accounting beta is insignificant. The change in the accounting beta coefficient suggests that size and growth might not adequately control for unexplained risk factors. With Fama-MacBeth adjustment, only the size control is negative and significant.

I next examine whether the positive association between the valuation errors and both accounting conservatism and the absolute value of past investment growth. Table 5.7 displays the results of tests of this association, after Fama-MacBeth adjustment. Neither the accounting beta valuation errors nor the stock returns beta valuation errors are significantly associated with the interaction between accounting conservatism and the absolute value of past investment growth. Therefore, after Fama-MacBeth adjustment, it is no longer clear whether the valuation errors for accounting beta or stock returns beta are associated with accounting conservatism and the absolute value of past investment growth so that I fail to reject the hypothesis that they are not associated. That is, Hypothesis 3 has only mixed support. Again, this might indicate the failure to control for other factors explaining the expected rate of return.

To investigate the possiblity that unexplained factors might explain the previous results, I again examine the differences between the valuation errors for accounting beta and stock returns beta across quintile portfolios for both accounting conservatism and past investment growth. Table 5.8 presents the results of testing the valuation error differences. Consistent with the main set of results, the valuation error differences for accounting beta and stock returns beta are increasingly positive for portfolios of firms having more conservative ac-

Table 5.6: Firm-Specific Valuation Error Estimation with Fama-MacBeth Adjustment

$(r_{peg,it} - rf_t) = \gamma_0 + \gamma_1\beta_{i,t} + \gamma_2 ln\,(mve_{it}) + \gamma_3 mb_{it} + \upsilon_{it}$					
	γ_0	γ_1	γ_2	γ_3	Adj. R^2
β_{it}^{roe}	0.0344**	-0.0004			0.2581
	(10.73)	(-1.18)			
	0.0617**	-0.0003	-0.0039**	-0.0003	0.3187
	(14.40)	(-0.77)	(-11.29)	(-1.20)	
β_{it}^{ret}	0.0253**	0.0076**			0.2688
	(5.58)	(4.93)			
	0.0512**	0.0073**	-0.0036**	-0.0002	0.0092
	(8.99)	(5.03)	(-9.64)	(-0.60)	

Notes: The table presents the coefficient estimates from Fama-MacBeth regressions of an implied cost of equity capital using a PEG ratio (r_{peg}) on each beta risk measure. r_{peg} equals the square root of the difference between 3-year-ahead and 2-year-ahead earnings forecasts, scaled by current price. Accounting beta (β_{it}^{roe}) is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on estimated excess market portfolio ROE. Stock returns beta (β_{it}^{ret}) is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. I estimate the Fama-MacBeth regressions by calendar year. (t-values are in parentheses. ** denotes significance at $p < 0.01$.)

counting and greater absolute values of past investment growth. The difference between the valuation error differences for the portfolio of firms having the highest proportion of conservative investment and highest absolute value of average past investment growth and the portfolio of firms having the lowest proportion of conservative investment and lowest absolute past investment growth is approximately a rate of return equal to 0.2%. Therefore, even after Fama-MacBeth adjustment, the differences between the accounting beta and stock returns beta valuation errors are in the anticipated direction.

5.3 Summary

I am unable to draw clear conclusions from the independent valuation error analyses. Although I continue to find that the valuation error differences between accounting beta and stock returns beta are positively associated with accounting conservatism and the absolute value of past investment growth, regressions analyses that directly examine the accounting beta distortions are less clear. The realized return analysis and the implied cost of equity capital analysis yield inconsistent associations between betas and accounting conservatism

Table 5.7: r_{peg} Valuation Error Tests with Fama-MacBeth Adjustment

$$\upsilon_{it} = \delta_0 + \delta_1 Conservatism_{it} + \delta_2 |PInvest_{it}| + \delta_3 Conservatism_{it} * |PInvest_{it}| + \eta_{it}$$

	β_{it}^{roe}	β_{it}^{ret}
Intercept	-0.002**	-0.001*
	(-4.17)	(-1.97)
$Conservatism_{it}$	-0.004**	-0.006**
	(-3.20)	(-4.64)
$\|PInvest_{it}\|$	0.033**	0.026**
	(9.86)	(7.92)
$Conservatism_{i,t} * \|PInvest_{i,t}\|$	-0.001	0.003
	(-0.16)	(0.53)
$Adj.R^2$	0.021	0.017

Notes: This table presents the results of Fama-MacBeth regressions of valuation errors for accounting beta (β_{it}^{roe}) or stock returns beta (β_{it}^{ret}) on accounting conservatism ($Conservatism_{it}$) and the absolute value of past investment growth ($PInvest_{it}$). The valuation errors are the residuals (υ_{it}) from regressions of implied cost of equity capital using a PEG ratio (r_{peg}) on each beta risk measure, controlling for size and growth. Accounting beta (β_{it}^{roe}) is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on estimated excess market portfolio ROE. Stock returns beta (β_{it}^{ret}) is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. $Conservatism_{it}$ equals R&D and advertising expenses divided by total investments. $|PInvest_{it}|$ is the geometric average of past total investment growth over the estimated average useful life of a firm's assets. t-values are in parentheses. *, and ** denote significance at $p < 0.05$ and $p < 0.01$, respectively.

Table 5.8: r_{peg} Valuation Error Differences (Fama-MacBeth)

$\upsilon_{it}^{roe} - \upsilon_{it}^{ret}$

$Conservatism_{it}$	$\lvert PInvest_{it}\rvert$ 1	2	3	4	5	$(5-1)$
1	-0.0011	-0.0008	-0.0003	-0.0001	0.0007	0.0017
	(-6.74)	(-4.95)	(-1.87)	(-0.48)	(2.79)	(6.03)
2	-0.0007	-0.0005	-0.0003	-0.0004	0.0010	0.0017
	(-4.79)	(-3.17)	(-1.62)	(-2.48)	(4.29)	(6.17)
3	-0.0005	-0.0004	-0.0003	-0.0004	0.0009	0.0014
	(-3.18)	(-2.93)	(-1.48)	(-2.14)	(3.63)	(4.74)
4	-0.0004	-0.0002	-0.0003	-0.0001	0.0014	0.0018
	(-2.25)	(-0.87)	(-1.65)	(-0.45)	(5.92)	(6.15)
5	-0.0002	0.0005	0.0002	0.0007	0.0016	0.0019
	(-1.25)	(2.39)	(1.12)	(2.84)	(6.09)	(5.64)
$(5-1)$	0.0008	0.0014	0.0006	0.0008	0.0009	0.0027
	(3.27)	(4.97)	(2.09)	(2.43)	(2.61)	(8.70)

Notes: This table presents the mean differences between valuation errors for accounting beta and stock returns beta across quintiles for accounting conservatism ($Conservatism_{it}$) and the absolute value of past investment growth ($|PInvest_{it}|$). Valuation errors are estimated as the residuals (υ_{it}) from Fama-MacBeth regressions of excess implied cost of equity capital estimated using a PEG ratio (r_{peg}) on either accounting beta or stock return beta, including controls for size and growth. r_{peg} equals the square root of the difference between three-year ahead and 2-year ahead earnings forecasts, scaled by current price. I calculate r_{peg} in excess of the risk free rate, which I estimate using the de-annualized monthly reported yield from a 10-year treasury bond. Accounting beta is the slope coefficient from a 10-year yearly regression of a firm's excess return on equity (ROE) on the estimated excess market portfolio ROE. Stock returns beta is the slope coefficient from a 5-year monthly regression of a firm's excess stock return on the excess market portfolio stock return. $Conservatism_{it}$ equals R&D and advertising expenses divided by total investments. $|PInvest_{it}|$ is the geometric average of past total investment growth over the estimated average useful life of a firm's assets. t-statistics are reported in parentheses. The t-statistics for the portfolio differences presented in the last row and last column assume unequal variances. The two numbers in the last row and last column evaluate the differences between the highest $Conservatism_{it}$ and $|PInvest_{it}|$ portfolio and the lowest $Conservatism_{it}$ and $|PInvest_{it}|$ portfolio.

and the absolute value of past investment growth. Stock returns beta also demonstrates an inconsistent association. Because of this, I conclude that the simple regressions of expected rates of return on each beta estimate are likely misspecified and that the consistent differencing tests between accounting beta and stock returns beta provide a solution to the misspecification problem.

CHAPTER 6

CONCLUSION

I examine how one broad set of accrual recognition methods, which I label conservative accounting, might affect risk analysis in valuation. I restrict my examination to the effects of conservative accounting on rate of return estimates that are derived from the Capital Asset Pricing Model (CAPM). The CAPM represents a traditional approach to modeling investment risk based on the covariance between an investment's return and the return obtained from a market-mimicking investment portfolio. Although prior literature suggests that the CAPM might not adequately model investment risk as implied by market returns, I focus on the CAPM in my analysis for two reasons. First, as stated previously, an objective of accounting is to provide the observables necessary to proxy for the key parameters among the set of risk models that are used by investors. Despite its limitations, the CAPM remains among the most popular risk models used by corporate managers to assess risk (Graham & Harvey, 2001). Second, recent literature suggests that the CAPM, when derived using accounting estimates of firm and market portfolio returns, yields, on average, superior risk estimates than when it is derived using stock market estimates of firm and market portfolio returns.

I extend the prior literature by predicting that accounting betas are not only a function of a firm's systematic risk, but also of its firm-specific accrual accounting methods. I examine whether the on-average superior performance of accounting betas over stock return betas is associated with a firm's level of conservative accounting methods. I predict that conservative accounting, when combined with past investment growth, biases accounting betas so that firms having more conservative accounting appear less risky than they truly are. Consequently, I also predict that accounting betas, when estimated for firms having more conservative accounting, will, on average, yield larger valuation errors than stock return betas that are estimated across the same set of firms.

I define conservative accounting as the set of accrual methods that reports an investment at a carrying value that yields an accounting rate of return greater than the internal rate of return based on the investment's original cost. I predict that because conservative accounting distorts accounting rates of return, it might also distort accounting betas.

I provide evidence consistent with my predictions. Specifically, I find that accounting betas are negatively associated with accounting conservatism and the absolute value of past investment growth. I also provide evidence that accounting betas yield larger valuation errors relative to stock returns beta in the presence of more conservative accounting combined with greater magnitudes of past investment growth. I document evidence that these results are insensitive to alternative measures for valuation errors and stock returns and accounting betas. I also find evidence that the results are not strictly driven by a few industries.

In further analysis, I attempt to examine accounting beta valuation errors independent of stock returns beta valuation errors. I obtain puzzling results that suggest that both accounting beta and stock returns beta valuation errors are negatively associated with accounting conservatism and the absolute value of past investment growth. The negative association disappears once I include a control for firm size. Because of this, I conclude that the simple regressions of expected rates of return on each beta estimate are likely misspecified and that the differencing tests between accounting beta and stock returns beta provide a solution to the misspecification problem.

Other areas for future research include examining other potential accounting distortions to accounting risk measures including accounting beta. In addition to examining distortions related to accounting conservatism, future research might examine distortions related to conditional accounting conservatism. Conditional accounting conservatism relates to accounting policies that make it more difficult to recognize positive performance than negative performance. For example, if poor performance is recognized when expected while positive performance news is recognized when realized, then ROE might better reflect actual market risk when calculated during periods with marketwide positive returns. Alternatively, investors' expectations might be more important to measuring market risk, especially for short-term investors.

Future research might examine the effects of earnings management on accounting risk measures. Another avenue of research might examine the risk-assessment quality of IFRS relative to GAAP since some prior research suggests IFRS might be less conservative (Ahmed, Neel, & Wang, 2009). Future research could also examine whether a combination of accounting-based and stock returns-based risk measures might overcome specific or general measurement distortions. Finally, research might also examine methods for redefining accounting betas or other accounting risk measures to avoid measurement distortions.

In summary, I contribute to the literature by exploring the extent to which accrual accounting methods distort accounting beta risk estimates. To my knowledge, I am the first to examine the association between accounting measurement attributes and accounting beta risk estimates. I document evidence that investors should consider firms' accrual accounting methods when assessing firm risk using accounting-based estimates. Further, when evaluating the relative valuation errors of accounting-based and market-based risk estimates, my results suggest that the relative superiority of accounting-based risk estimates is contextual. While prior research suggests that, on average, accounting beta estimates are superior to stock return beta estimates, my findings suggests that by understanding the impact of accounting conservatism and investment growth on accounting betas, practitioners and researchers can better choose the appropriate risk measure. My results suggest that (1) accounting betas are negatively biased by conservative accounting and (2) that stock return betas provide a superior meaure of risk over accounting betas for firms that use more conservative accounting during periods of highly fluctuating economic growth.

APPENDIX

A DEMONSTRATION OF THE THEORY

To help illustrate the association among accounting rates of return, changes in net investment growth, and conservative accounting treatment and also to help motivate my hypotheses regarding the related rate of return effects upon earnings betas, I provide several examples using an all-equity firm that pays its entire earnings as dividends each period.[1] Each year-end, the firm invests in assets having a rate of return equal to the firm's 10% cost of capital. The assets have 2-year productive lives that the firm splits equally over 2 years. For simplification, I assume operating expenses consist solely of depreciation so that the rate of return effects of conservatism and growth are demonstrated by varying both the firms' depreciation schedule and its new investment growth rate. Because I assume the firm is financed entirely by equity, the return on net operating assets (RNOA) provided in each example is equivalent to the firm's return on equity (ROE).

In the first set of examples provided in Table A.1, I compare a "neutral accounting" firm in Panel A to a "conservative accounting" firm in Panel B. The neutral accounting firm depreciates its investments equally over their 2-year productive lives. In contrast, the conservative accounting firm depreciates its new investments by 60% in the purchase year, 30% in the first productive year, and 10% in the second productive year. To demonstrate the joint effects of conservatism and changes to investment growth on the firm's RNOA , the firm's investment growth steadily rises and falls in each example.

Panel A shows that when investments are expensed in accordance with their productive lives, RNOA remains unchanged despite changes to investment growth rates. The firm's sales correspond to its operating expenses so that neither current-period earnings nor subsequent period book values are biased, allowing RNOA to remain constant over time as growth rates change. Further, firm RNOA properly reflects the firm's cost of capital.

[1] I derive my examples from Penman (2010b)

Table A.1: Accounting Rates of Return Across Varying Investment Rates and Alternative Depreciation Schedules

Panel A: Firm equally depreciating assets in years 1 and 2:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Sales	0	240	460	462	472	491	516	541	568	591	602
Depreciation	0	200	400	402	410	427	448	470	494	513	524
Net income	0	40	60	60	62	64	68	71	75	77	79
Beg. NOA	0	400	600	604	618	645	677	711	747	774	787
New investment	400	400	404	416	437	459	482	506	521	526	526
Depr. investment	0	200	400	402	410	427	448	470	494	513	524
Ending NOA	400	600	604	618	645	677	711	747	774	787	789
Investment growth		1.00	1.01	1.03	1.05	1.05	1.05	1.05	1.03	1.01	1.00
RNOA		0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10

Panel B: Firm accelerating depreciation to 60% in the initial year and 30% and 10% in years 1 and 2, respectively:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Sales	0	240	460	462	472	491	516	541	568	591	602
Depreciation	240	360	402	411	427	448	470	494	512	523	526
Net income	(240)	(120)	58	52	44	43	45	47	56	68	77
Beg. NOA	0	160	200	202	207	216	227	239	250	259	263
New investment	400	400	404	416	437	459	482	506	521	526	526
Depr. investment	240	360	402	411	427	448	470	494	512	523	526
Ending NOA	160	200	202	207	216	227	239	250	259	263	263
Investment growth		1.00	1.01	1.03	1.05	1.05	1.05	1.05	1.03	1.01	1.00
RNOA		(0.75)	0.29	0.26	0.22	0.20	0.20	0.20	0.22	0.26	0.29

Numbers rounded.

Panel B is slightly more complicated. Focusing on periods subsequent to 2001, the first notable difference between Panel A and Panel B is that RNOA appears much higher in Panel B. In general, the higher RNOA occurs because conservative accounting treatment records net assets at less than their true holding values so that the same net income each period appears generated from fewer net assets from the prior period. However, rather than RNOA levels, my hypotheses relate to the changes in RNOA as a firm alters its investment growth rates. From 2002 to 2004, as the firm grows its net investments, RNOA decreases from 0.29 to 0.22. The decrease occurs because conservatism combines with the increased rate of investment to cause current period expenses to grow at a faster rate than the decline in prior period book values. Similarly, from 2008 to 2010, RNOA increases because the slowing rate of investment reduces current period expenses faster than the reduction in prior period book values. When investment growth remains unchanged, as in periods 2005 to 2007, RNOA stabilizes as the year-over-year proportion of current period net income to prior period book value remains constant. In summary, RNOA decreases as conservative accounting firms increase their investment growth rates and it increases as conservative accounting firms decrease their investment growth rates. RNOA remains unchanged when conservative accounting firms do not change their investment growth rates.

My hypotheses relate to how conservatism and changes to investment growth rates are associated with the systematic variation in earnings betas. Table A.1 shows how conservatism and investment growth can produce greater variation in firms' RNOA. The example, however, does not yet clearly portray how conservatism and changes to investment growth rates might affect earnings betas. The reason is that the firm's rate of return is not yet associated with the market so as to provide an indication of comovement between firm accounting rates of returns and the accounting rate of return from a market portfolio.

For simplification, I assume market portfolio performance is perfectly correlated with the firm's changing investment growth rates.[2] Table A.2 provides two additional examples where firm sales are now also a function of market performance. Firm investments earn a rate of return equal to the firm's cost of capital plus a premium corresponding to the performance of the market. I initially set the market premium equal to 100 in 2001, and then allow the premium to adjust to the marketwide growth thereafter. For years 2002, 2003, and 2004, the market premium is 101, 104, and 109, corresponding to the 1%, 3%,

[2]In my hypotheses for earnings beta, I similarly assume that firms having rates of return that comove with the market will also have investment rates that comove with the market. The assumption is consistent with firms having, on average, procyclical rates of investment where firms have higher short-term rate-of-return expectations during economic expansions than during economic contractions (Stock & Watson, 1999).

Table A.2: Accounting Rates of Return when Sales Earn a Premium with the Market

Panel A: Firm equally depreciating assets in years 1 and 2:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Sales	0	340	561	566	581	606	636	668	699	722	734
Depreciation	0	200	400	402	410	427	448	470	494	513	524
Net income	0	140	161	164	171	179	188	198	205	209	210
Beg. NOA	0	400	600	604	618	645	677	711	747	774	787
New investment	400	400	404	416	437	459	482	506	521	526	526
Depr. investment	0	200	400	402	410	427	448	470	494	513	524
Ending NOA	400	600	604	618	645	677	711	747	774	787	789
Investment growth		1.00	1.01	1.03	1.05	1.05	1.05	1.05	1.03	1.01	1.00
RNOA		0.35	0.27	0.27	0.28	0.28	0.28	0.28	0.27	0.27	0.27

Panel B: Firm accelerating depreciation to 60% in the initial year and 30% and 10% in years 1 and 2, respectively:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Sales	0	340	561	566	581	606	636	668	699	722	734
Depreciation	240	360	402	411	427	448	470	494	512	523	526
Net income	(240)	(20)	159	156	154	158	166	174	186	200	208
Beg. NOA	0	160	200	202	207	216	227	239	250	259	263
New investment	400	400	404	416	437	459	482	506	521	526	526
Depr. investment	240	360	402	411	427	448	470	494	512	523	526
Ending NOA	160	200	202	207	216	227	239	250	259	263	263
Investment growth		1.00	1.01	1.03	1.05	1.05	1.05	1.05	1.03	1.01	1.00
RNOA		(0.13)	0.79	0.77	0.74	0.73	0.73	0.73	0.74	0.77	0.79

Numbers rounded.

and 5% year-over-year perfectly correlated growth in investment. All other assumptions for Panels A and B are the same as before.

In Panel A, the firm's RNOA is nearly perfectly correlated with market growth rate, consistent with the firm earning a premium on investment that is perfectly correlated with the market.[3] For neutral accounting firms, the higher rate of return is appropriately matched with the investment of the prior period. For conservative accounting firms, however, the correlation changes. In Panel B, RNOA is nearly perfectly negatively correlated with the market. Due to the interaction effects between conservatism and investment growth, RNOA continues to move opposite the market. The effects would be less (more) pronounced for less (more) conservative accounting treatment.

Earnings betas measure firm risk as the comovement between a firm's rate of the return and the market rate of return. If firm's vary cross-sectionally in their conservative accounting treatment and investment growth rates, the conservative accounting firms may appear less risky than their underlying operations would imply based on a CAPM model of risk. Using RNOA in Panel A as a proxy for the market portfolio, the earnings beta for Panel B equals -0.14, compared to 1 for Panel A. If the firm in Panel A more closely proxies the market, the example suggests that the firm in Panel B would have a negative earnings beta even though the two firms are identical except for their depreciation methods. Consequently, I predict that firms having greater changes to their investment growth rates and more conservative accounting have smaller earnings betas than firms with more stable investment growth and more neutral accounting methods.

[3] I exclude the 2000 and 2001 data from the correlation calculations.

REFERENCES

Ahmed, A. S., Neel, M., & Wang, D. (2009). The effect of mandatory adoption of international financial reporting standards on accounting quality: Preliminary evidence. Working Paper.

Baginski, S. P., & Wahlen, J. M. (2003). Residual income risk, intrinsic values, and share prices. *The Accounting Review*, *78*(1), 327–351.

Banz, R. W. (1981). The relationship between return and market value of common stocks. *Journal of Financial Economics*, *9*(1), 3–18.

Basu, S. (1977). Investment performance of common stocks in relation to their price-earnings ratios: A test of the efficient market hypothesis. *The Journal of Finance*, *32*(3), 663-682.

Basu, S. (1997). The conservatism principle and the asymmetric timeliness of earnings. *Journal of Accounting and Economics*, *24*(1), 3–37.

Beaver, W. H., Kettler, P., & Scholes, M. (1970). The association between market determined and accounting determined risk measures. *The Accounting Review*, *45*(4), 654–682.

Beaver, W. H., & Ryan, S. G. (2000). Biases and lags in book value and their effects on the ability of the book-to-market ratio to predict book return on equity. *Journal of Accounting Research*, *38*(1), 127–148.

Berk, J. B. (1995). A critique of size-related anomalies. *Review of Financial Studies*, *8*(2), 275–286.

Black, F. (1972). Capital market equilibrium with restricted borrowing. *The Journal of Business*, *45*(3), 444–455.

Black, F., Jensen, M. C., & Scholes, M. (1972). The Capital Asset Pricing Model: Some empirical tests. In M. C. Jensen (Ed.), *Studies in the theory of capital markets* (pp. 79–124). Praeger, NY: Praeger Publishers Inc.

Blume, M. E., & Friend, I. (1973). A new look at the Capital Asset Pricing Model. *The Journal of Finance*, *28*(1), 19–33.

Botosan, C. A., & Plumlee, M. A. (2005). Assessing alternative proxies for the expeced risk premium. *The Accounting Review*, *80*(1), 21–53.

Botosan, C. A., Plumlee, M. A., & Wen, H. (2011). The relation between expected returns, realized returns, and firm risk characteristics. *Contemporary Accounting Research*, *28*(4), 1085–1122.

Brainard, W. D., Shapiro, M. D., & Shoven, J. B. (1991). Fundamental value and market value. In W. C. Brainard, W. D. Nordhaus, & H. W. Watts (Eds.), *Money, maroeconomics, and economic policy: Essays in honor of James Tobin* (pp. 277–307). Cambridge, MA: MIT Press.

Campbell, J. Y., Lo, A. W., & MacKinlay, A. C. (1997). *The econometrics of financial markets.* Princeton, NJ: Princeton University Press.

Cohen, R. B., Polk, C., & Vuolteenaho, T. (2003). The value spread. *The Journal of Finance*, *58*(2), 609–641.

Cohen, R. B., Polk, C., & Vuolteenaho, T. (2009). The price is (almost) right. *The Journal of Finance*, *64*(6), 2739–2782.

De Bondt, W. F. M., & Thaler, R. (1985). Does the stock market overreact? *Journal of Finance*, *40*(3), 793–805.

Easton, P. D., & Monahan, S. J. (2005). An evaluation of accounting-based measures of expected returns. *The Accounting Review*, *80*(2), 501–538.

Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *The Journal of Finance*, *47*(2), 427–465.

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, *33*(1), 3–56.

Fama, E. F., & French, K. R. (1995). Size and book-to-market factors in earnings and returns. *The Journal of Finance*, *50*(1), 131–155.

Fama, E. F., & French, K. R. (1996). The CAPM is wanted, dead or alive. *The Journal of Finance*, *51*(5), 1947–1958.

Fama, E. F., & French, K. R. (1997). Industry costs of equity. *Journal of Financial Economics*, *43*(1), 153–193.

Fama, E. F., & French, K. R. (2004). The Capital Asset Pricing Model: Theory and evidence. *Journal of Economic Perspectives*, *18*(3), 25–46.

Fama, E. F., & MacBeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. *The Journal of Political Economy*, *81*(3), 607–636.

Feltham, G. A., & Ohlson, J. A. (1999). Residual earnings valuation with risk and stochastic interest rates. *The Accounting Review*, *74*(2), 165–183.

Gjesdal, F. (2004). A steady state growth valuation model: A note on accounting and valuation. Working Paper.

Graham, J. R., & Harvey, C. R. (2001). The theory and practice of corporate finance: evidence from the field. *Journal of Financial Economics*, *60*(1), 187–243.

Greenball, M. N. (1969). Appraising methods of accounting for accelerated tax depreciation: A relative-accuracy approach. *Journal of Accounting Research*, *7*(2), 262–289.

Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of Finance*, *48*(1), 65–91.

Kandel, S., & Stambaugh, R. F. (1987). On correlations and inferences about mean-variance efficiency. *Journal of Financial Economics*, *18*(1), 61–90.

Kothari, S. P., Shanken, J., & Sloan, R. G. (1995). Another look at the cross-section of expected stock returns. *The Journal of Finance*, *50*(1), 185–224.

La Porta, R. (1996). Expectations and the cross-section of stock returns. *The Journal of Finance*, *51*(5), 1715–1742.

Lintner, J. (1965). The valuation of risky assets and the selection of risky investments in stock portfolios and capital budgets. *The Review of Economics and Statistics*, *47*(1), 13–37.

Lo, A. W., & MacKinlay, C. (1990). Data-snooping biases in tests of financial asset pricing models. *Review of Financial Studies*, *3*(3), 431–467.

Markowitz, H. (1959). *Portfolio selection: Efficient diversification of investments.* New York, NY: John Wiley & Sons, Inc.

Nekrasov, A., & Shroff, P. K. (2009). Fundamentals-based risk measurement in valuation. *The Accounting Review*, *84*(6), 1983–2011.

Nissim, D., & Penman, S. H. (2001). Ratio analysis and equity valuation: From research to practice. *Review of Accounting Studies*, *6*(1), 109–154.

Penman, S. H. (2010a). Financial forecasting, risk and valuation: Accounting for the future. *Abacus*, *46*(2), 211–228.

Penman, S. H. (2010b). *Financial statement analysis and security valuation* (4th ed.). New York, NY: McGraw-Hill Irwin.

Penman, S. H., & Zhang, X.-J. (2002). Accounting conservatism, the quality of earnings, and stock returns. *The Accounting Review*, *77*(2), 237–264.

Rajan, M. V., Reichelstein, S., & Soliman, M. T. (2007). Conservatism, growth, and return on investment. *Review of Accounting Studies*, *12*(2–3), 325–370.

Roll, R. (1977). A critique of the asset pricing theory's tests: Part I: On past and potential testability of the theory. *Journal of Financial Economics*, *4*(2), 129–176.

Ross, S. A. (1976). The arbitrage theory of capital asset pricing theory. *Journal of Economic Theory*, *13*(3), 341–360.

Shanken, J. (1987). Multivariate proxies and asset pricing relations: Living with the Roll critique. *Journal of Financial Economics*, *18*(1), 91–110.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, *19*(3), 425-442.

Sloan, R. G. (1996). Do stock prices fully reflect information in accruals and cash flows about future earnings. *The Accounting Review*, *71*(3), 289–315.

Stambaugh, R. F. (1982). On the exclusion of assets from tests of the two parameter model. *Journal of Financial Economics*, *10*(3), 235–268.

Stock, J. H., & Watson, M. W. (1999). Business cycle fluctuations in U.S. macroeconomic time series. In J. B. Taylor & M. Woodford (Eds.), *Handbook of macroeconomics* (Vol. 1, pp. 3–64). Elsevier.

Vuolteenaho, T. (2001). Understanding the aggregate book-to-market ratio and its implications to current equity-premium expectations. Working paper.

Vuolteenaho, T. (2002). What drives firm-level stock returns? *The Journal of Finance*, *57*(1), 233–264.